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THE WILSON ORNITHOLOGICAL CLUB

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Named after ALEXANDER WILSON, the first American ornithologist.

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The Wilson Ornithological Club Library, housed in the University of Michigan Museum of Zoology, was established in concurrence with the University of Michigan in 1930. Until 1947 the Library was maintained entirely by gifts and bequests of books, pamphlets, reprints, and ornithological magazines from members and friends of the Wilson Ornithological Club. Now 2 members have generously established a fund for the purchase of new books; members and friends are invited to maintain the fund by regular contributions, thus making available to all Club members the more important new books on ornithology and related subjects. The fund will be administered by the Library Committee, which will be glad of suggestions from members on the choice of new books to be added to the Library. Harold F. Mayfield (2557 Portsmouth Avenue, Toledo, Ohio) is Chairman of the Committee. The Library currently receives 65 periodicals, as gifts, and in exchange for *The Wilson Bulletin*. With the usual exception of rare books in the collection, any item in the Library may be borrowed by members of the Club and will be sent prepaid (by the University of Michigan) to any address in the United States, its possessions, or Canada. Return postage is paid by the borrower. Inquiries and requests by borrowers, as well as gifts of books, pamphlets, reprints, and magazines, should be addressed to "The Wilson Ornithological Club Library, University of Michigan Museum of Zoology, Ann Arbor, Michigan." Contributions to the New Book Fund should be sent to the Treasurer, Burt L. Monroe, Ridge Road, Anchorage, Kentucky (small sums in stamps are acceptable). A preliminary index of the Library's holdings was printed in the September 1943 issue of *The Wilson Bulletin*, and each September number lists the book titles in the accessions of the current year. A brief report on the recent gifts to the Library is published in every issue of the *Bulletin*.

THE WILSON BULLETIN

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All articles and communications for publication, books and publications for review, and claims for lost or undelivered copies of the magazine, should be addressed to the Editor. Exchanges should be addressed to the Wilson Ornithological Club Library, Museum of Zoology, Ann Arbor, Michigan.

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WILSON CLUB NEWS

1949 Award of the Louis Agassiz Fuertes Grant

The Louis Agassiz Fuertes Grant of $100 for 1949 has been awarded to Mr. Stephen W. Eaton of Cornell University in recognition of his progress and as encouragement for further work on the taxonomy and comparative life history of the water-thrushes.

The Louis Agassiz Fuertes Research Fund was established by an anonymous friend of the Wilson Ornithological Club in 1947. Its purpose is to assist and encourage field research in Ornithology through the awarding of annual grants of $100 to an applicant selected by the undersigned committee. Selection is made on the basis of: (1) merits of the project, (2) prospects of successful completion of the project, (3) displayed or reported ability of the applicant, and (4) financial need. The award is open to any member of the Wilson Ornithological Club and all who are interested are urged to apply.

John T. Emlen, Jr., Chmn.
George H. Lowrey, Jr.
Ernst Mayr
Mrs. Margaret M. Nice
Frank A. Pitelka
Josselyn Van Tyne

Mr. Donald Malick has been awarded $25 from the S. Morris Pell fund in recognition of his ability and promise as a bird artist. This fund, totalling $100, was given to the Wilson Ornithological Club by a friend in memory of the late S. Morris Pell. It is to be used to help promising young bird artists as announced in the September 1948 issue of the *Bulletin*, p. 192. Awards are made by the Research Committee.

The Sixty-Seventh Stated Meeting of the American Ornithologists' Union will be held October 10–14, 1949, at Buffalo, New York. Hosts for the meeting will be the Buffalo Ornithological Society and the Buffalo Society of Natural Sciences. Public sessions will be held October 11–13, 1949 at the Buffalo Museum of Science. The headquarters hotel will be the Hotel Statler where the banquet will be held on Wednesday evening, October 12.

EDITORIAL

Because a number of members have inquired about the reasons for a change in size, it is desirable to explain that the new printer, who was chosen for efficiency, does not have machines set to trim to the former size. However, the type bed is larger and actually about a page of additional print is thereby possible on the same number of pages.

CORRECTION: Vol. 61, p. 48, line 2; for "Cayuga" read "Keuka".

THE PRESIDENT'S PAGE

Since its beginning in 1930, the Wilson Ornithological Club Library has gradually increased in size through (1) gifts of books, pamphlets, and periodicals, (2) occasional purchases of much needed books, using cash obtained by contributions to the New Book Fund or from the sale of duplicate items, and (3) exchanges for *The Wilson Bulletin*. At the present time the Library contains approximately 400 volumes (books and bound volumes of serial publications) and 4500 pamphlets.

The Library is located at Ann Arbor in the University of Michigan's Museum of Zoology, sharing a room with the Library of the Division of Birds. It is separately shelved and catalogued, and in each volume there is a handsome bookplate showing a Long-eared Owl, from a drawing by George Miksch Sutton.

The primary purpose of the Library is to serve those Club members who do not have access locally to adequate reference material. Members may use it in two ways: (1) They may use it in the library room, in which case they may also have the privilege of using the Library of the Division of Birds. (2) They may write in and borrow items. (See the instructions for borrowing on the inside front cover of this number.) By arrangement with the University of Michigan, our collection is not only allowed permanent housing, but also such valuable services as cataloguing and shelving all items received, binding and repairs, transportation costs one way on loans to any address in the United States or Canada.

There is every evidence that the purpose of the Library is being well fulfilled. Each month many items are borrowed by mail. Quite frequently borrowers live in places hundreds of miles from the nearest reference sources. Of the various items borrowed, new books head the list.

In view of the important service which our Library is performing, we should make a great effort to keep it up to date, to augment as rapidly as possible the collection of rare and out of print books and pamphlets, and to complete the files of serials. There are at least three ways in which these objectives can be met: (1) By monetary contributions. Already a Book Fund has been generously established by two members and is being used for the purchase of newly published books. Additions to this fund would permit us to obtain worthwhile books as they appear on the market. (2) By gifts of publications. In case such gifts should duplicate certain items already in the Library, they can be readily sold and the money received can be turned over to the Book Fund or they will be returned to the donors. (3) By gifts of new books and reprints of papers. All authors are particularly requested to remember the Library when giving away copies of their latest publications.

Of the various functions of the Wilson Club, the maintenance of our Library is one of the most important. Like our *Bulletin* and the annual meeting, it is a means of advancing the science of ornithology, the object to which we are dedicated. Any contribution, however modest, is most welcome.

OLIN SEWALL PETTINGILL, JR.

COLIMA WARBLER AT ITS NEST

THE NEST OF THE COLIMA WARBLER IN TEXAS

EMMET R. BLAKE

SINCE its discovery in the Sierra Nevada de Colima, Mexico, in 1889 the Colima Warbler (*Vermivora crissalis*) has remained one of the rarest and least known members of its family. As recently as 1928 the species was represented in collections by only 11 Mexican specimens collected in widely separated localities, and virtually nothing had been learned of its habits.

An adult male taken by Dr. Frederick M. Gaige in the Chisos Mountains, Brewster County, Texas on July 20, 1928 extended the Colima Warbler's range northward from the Sierra Guadaloupe, Coahuila, and brought the species within the scope of the A.O.U. check-list for the first time. Four years later a concerted effort was made by competent ornithologists to study the breeding population found in Boot Canyon, locale of Gaige's first American record. The very satisfactory results of these studies, including photographs and a description of the first Colima Warbler nest and eggs known to science, have been published by Van Tyne (Misc. Publ., Mus. of Zool., Univ. Mich., No. 33, 1936, pp. 5–11).

In May and June, 1941, Melvin A. Traylor, Jr. and I spent approximately 4 weeks in the Chisos Mountains while conducting special studies of the nesting birds of the area for the Chicago Natural History Museum. We had numerous opportunities to observe the local, and evidently isolated, breeding population of Colima Warblers while occupying a camp maintained at Boot Spring (alt. 7500 ft.) from May 22 until June 7. Unfortunately the demands of other duties prevented our undertaking a detailed study of these birds, but certain observations made while photographing the nesting birds add somewhat to our knowledge of this exceedingly rare species.

Our initial camp in the Chisos Mountains was established May 15 in the "Bowl", present site of the Park Administration Headquarters. The semi-arid and generally precipitous slopes of the vicinity support a profuse upper Sonoran flora characterized by juniper, yucca, sotol and staghorn cholla. Ecological conditions in the Bowl itself do not at all meet the requirements of the Colima Warbler, nor was it found with representative Transition elements that occurred in an oak forest on the south-eastern perimeter.

Colima Warblers were first heard singing near the head of Boot Valley on May 22. The relatively well watered and untouched forest of this isolated valley consists principally of maple, oak, Arizona cypress and yellow pine, the latter being most prominent on exposed ridges above 7500 feet altitude. Colima Warblers were extraordinarily abundant throughout deciduous forest and it was not unusual to hear 3 or even 4 birds singing at once in as many directions,

particularly during the mornings. Although no methodical census in Boot Valley was undertaken, I am certain that not fewer than 15, and very probably more, individuals were identified in various parts of the area by song alone. An estimate of the total numbers of breeding pairs occupying the valley during the summer of 1941 should considerably exceed this figure if it is assumed that the species also occurred in those parts of the area, no less suited to its needs, that we failed to visit.

Discovery of the first Colima Warbler nest known to science was made by Van Tyne (loc. cit.) in Boot Canyon on May 7, 1932. A second nest was found in the same locality by Sutton on May 20, 1933. These and 4 additional nests subsequently found in the vicinity of Boot Spring by the Chicago Museum expedition evidently represent the only definite nesting records of a species that is believed to occupy a breeding range extending from Texas (Chisos Mts. only) southward at least to Miquihuana, Tamaulipas.

A nest containing 4 highly incubated eggs was found May 25 embedded in the earth at the base of a clump of "goats-beard" grass (*Piptochaetium fimbriatum*) from which an adult was flushed. The nest was perfectly concealed from all sides by the dense overhanging growth. It consisted solely of a symmetrical cup woven entirely from fine rootlets and grass stems to a thickness of 0.5 inches. Inside dimensions of the cup were approximately 2.25 by 2.25 inches. The eggs, which were permitted to hatch, were creamy white, unevenly speckled and rather boldly blotched—particularly at the larger end—with shades of brown and cinnamon.

On May 28 Traylor found a second nest containing 4 eggs under a root at one side of a dry stream-bed. In this instance also, the bird had to be flushed from the nest several times before its exact location among the oak leaves could be determined. The outer portion of this nest, which we collected, consists of moss, although the cup itself is woven from fine rootlets and grass stems. It has an inside diameter of 2.25 inches and measures 1.75 inches in depth. The eggs were entirely concealed from above by the root, and by dead leaves that formed a partial dome over the nest.

A third nest was discovered May 29 on a hillside about 200 yards above Boot Spring. Although not actually domed, this nest was well concealed by ground cover that prevented its detection at a distance of 6 or 8 feet. Four young birds approximately 2 days old occupied the nest. A fourth and last Colima Warbler nest containing 4 well-feathered juveniles was found June 6 embedded in the earth among clumps of grass (*Piptochaetium*) on a fairly open hillside near Boot Spring when an adult was flushed directly from the nest.

Absence of a brood patch in breeding male Colima Warblers has been remarked by others. Nevertheless, my observations indicate that the male attends the nestlings assiduously, as does the female. Between visits the male sang periodically, but briefly, in small trees in the vicinity. The young were

fed at frequent intervals by both adults. Food brought to the nestlings consisted solely of animal matter. Small, green caterpillars, otherwise unidentified, were most frequently provided, but the young occasionally received small grasshoppers, or similar insects as well. Cooperative care of the young also extended to the removal of fecal matter. This was accepted and carried away by the adults indiscriminately, but I was unable to determine its ultimate disposition.

The present status of the breeding colony of Colima warblers in the Chisos Mountains is uncertain. I have been informed (April 18, 1948) by Mr. Peter Kock, well-known wildlife lecturer of Marathon, Texas that he failed to find the species in Boot Valley during several summer visits in 1947, although he had noted it there in previous years.

Summary

North of Mexico, Colima Warblers are known only from the Chisos Mountains, in Brewster County, Texas, where the species was first reported July 20, 1928.

Numerous breeding birds were observed in the Boot Canyon section of the Chisos from May 22 until June 7, 1941. The local population, estimated from singing males, exceeded 15 pairs.

Four nests discovered May 25, 28, 29 and June 6 were uniform in construction, the symmetrical bowl of each being woven from fine rootlets or grass stems, and embedded to ground level. Concealment was excellent. Four eggs constitute a normal clutch. Egg-laying occurs principally during the second half of May.

The Chisos population has been reported absent since 1946.

Chicago Natural History Museum, Chicago, Illinois

AGE GROUPS AND LONGEVITY IN THE AMERICAN ROBIN: COMMENTS, FURTHER DISCUSSION, AND CERTAIN REVISIONS

DONALD S. FARNER

SINCE the publication of an analysis of the recoveries and returns of American Robins (*Turdus migratorius*), banded as young, in terms of age groups, mortality rates, survival rates, and longevity (Farner, 1945), publications of other investigators and the results of the author's own further studies make it desirable to present certain comments, additions, and observations.

The author, although accepting full responsibility for the contents of this paper, wishes to acknowledge the truly helpful assistance, suggestions, and criticisms kindly contributed by Margaret M. Nice, Harold Michener, Alden H. Miller, Morris S. Knebelman, Morris Rockstein, David Lack, Charles F. Yocum, and Elizabeth Brown Chase. Appreciation is again expressed for the kind cooperation of F. C. Lincoln, John W. Aldrich, Seth Low, and Chandler Robbins of the Fish and Wildlife Service in making records from the bird-banding files available to the author.

THE INITIAL DATE FOR THE ESTIMATION OF LONGEVITY, LIFE EXPECTANCY, AND AGE GROUPS

In the estimation of longevity, life expectancy, and age groups from the records of recovered birds which were banded as young it is necessary to fix an arbitrary initial date. To avoid bias in the sample of recovered birds this date must be placed sufficiently beyond the time of departure from the nest to allow the banded young to disperse. There is not sufficient information for the evaluation of the high rate of mortality before this dispersal and there is also the possibility that a dead banded bird of the year may have a better chance of being recovered through the activity of the bander before the dispersal than after. The initial calculations for the American Robin were based on the first of August as had been done by Lack (1943a, b, c, d) in his studies on several European species. On this basis, a higher mortality rate was obtained for the American Robin for the first year than when a later date, such as the first of November, was used. Because it could not be demonstrated satisfactorily whether this rate was actually higher or only apparently so because of bias of the sample, the earliest date by which it appeared that the migratory habits of the species would insure the necessary dispersal of the banded young was selected. The date thus chosen was November 1. Kraak, Rinkel, and Hoogerheide (1940) in their analysis of the records of recovered Lapwings used January 1 as the initial date; Marshall (1947) has used September 1 in his study of

Herring Gulls; whereas Plattner and Sutter (1947) used November 1 in their studies on Tits and Nuthatches. The question was raised (Farner, 1945: 58) whether the higher first-year mortality rates found by Lack, using August 1 as the initial date, were real or the result of bias of the sample in the manner described above. In consequence of this suggestion Lack (1946a, b) has reanalyzed the data on the European Blackbird, the Song Thrush, the Starling, and the Lapwing. The results indicate that the higher rates calculated from August 1 are genuine and not the result of biassed samples, and that this higher mortality rate persists approximately through December. Lack, however, (1946a: 263) suggests that in the future, annual mortality rates based on records of banded birds be calculated as of January 1. This procedure should eliminate the possibility of biassed samples as well as the period of increased and unstable juvenile mortality rate following the departure from the nest. Of minor consideration is the increased ease of calculation with January 1 as the initial date. The author agrees with Lack's recommendation that such future studies involving records of banded birds be based on the first January 1 as the initial date, at least for passerine species. It seems desirable, therefore, to present a recalculation of the more pertinent data of the earlier analysis of recovered Robins despite the fact that the results show no significant differences if one considers the size of the samples. (See Table 1, lines 1, 2, and 3; and Table 2, lines 1 through 4.)

Studies of the type presented in this paper are based on two fundamental assumptions. First, the sample used is sufficiently random and unbiassed to allow the calculation of a mortality rate and the construction of an average pattern of death about which the annual mortality rates and the patterns of death in the total population each year should fall in approximately normal frequency curves. Secondly, the population of the species involved is relatively stable, *i. e.*, its number is approximately the same on the same date each year, for example, on the successive January firsts of this study. The second assumption is particularly involved in calculations of longevity from annual mortality rate.

The annual mortality rate (M), as of a selected initial date, which in this study is the first January 1 in the life of the bird, may be obtained by dividing the number of birds which were alive on the initial date and which died during the ensuing year by the total alive on the initial date. In this study the mean M is obtained by dividing the number of birds recovered between the first and second January firsts (291) by the total number of dead birds recovered (M = 291/597 = 49%). Likewise, since the annual survival rate (S) may be obtained by dividing the number of those which were alive at the initial date and which survived the ensuing year by the total number in the sample, in this study (S = 306/597 = 51%). In these calculations the mortality rate is actually based on the year following the first January 1 and it is assumed that

the mortality rate is approximately the same in all age groups, which is substantially true. However, to avoid inaccuracies which may occur because of different mortality rates in different age groups, the method used by Lack (1948: 266) and in my earlier paper (Farner, 1945: 62) is used in line 3 of Table 2. In this method the mortality rate is calculated by dividing the total deaths (597) by the total of birds alive on all January firsts (1148). This process may be expressed as:

$$M = \frac{D_1 + D_2 + D_3 \cdots}{D_1 + 2D_2 + 3D_3 \cdots}$$

where D_1, D_2, D_3, etc., are the numbers of birds recovered each year, after the first January first. M thus computed is actually a weighted average of M values for each age group; the weighting factor, in each case, is the number of individuals on which each M is based.

Thus, in this study,

$$M = \frac{597}{1148} = 52\%$$

$$S = 100 - 52 = 48\%$$

In comparing my calculations with those of Lack an important difference in method should be mentioned. Lack (1948: 264–266) assumes, in calculating expectancy, that there is a uniform monthly distribution of deaths and that the mean period lived after the beginning of the year in which death occurs is 0.5 years. This period is herein designated as p. According to Lack the purpose of this arbitrary value is to avoid the effect of seasonal bias in the recovery of dead birds. The assumption of a uniform monthly distribtion only crudely approximates the effect of the action of a uniform mortality rate. For example, an annual survival rate of 50%, is the result of a monthly survival rate of 94.8 %. (Monthly survival rate = $\sqrt[12]{\text{annual survival rate}}$; see Tinbergen, 1946: 30.) Thus the mean period (p) after the first of the year lived by the birds which die during the year would be about 0.45 years which is scarcely significantly different from Lack's assumption of 0.5 years.

In the calculation of p by the use of the monthly survival rate ($\sqrt[12]{S}$), it is assumed that the mean period lived by birds in the month in which their deaths occur is 0.5 months. This involves, in principle, an error analogous to Lack's assumption in the use of annual mortality rates, that is, the mean period (p) lived during the year of death is 0.5 years. However, the error is scarcely significant in consideration of the accuracy of the data to which these calculations are compared. In the calculation of p from S, accuracy depends on the interval selected; for example, the application of a weekly survival rate ($\sqrt[52]{S}$) gives greater refinement than the use of the monthly rate. The general equation for the calculation of the population size (N_t) at a given time t is

$$N_t = N_o (\sqrt[i]{S})^t \qquad (1)$$

where N_o is the size of the population (number of live birds) at the beginning of the year (January 1); N_t is the number of birds alive at time t; t is time from the first of the year expressed in terms of selected time intervals; i is the number of time intervals in the year; and S is the annual survival rate. If i is 12 equal time intervals, *i.e.* months, where $t = 6$; or, if i is 365 equal time intervals, *i.e.* days, and $t = 211$, reference is made to a period extending from 1 January to the end of the sixth month, June.

From equation (1) an equation for the calculation of p, the mean period lived during the year of death, can be erected:

$$p = \frac{(N_o - N_1)\frac{1}{2i} + (N_1 - N_2)\frac{3}{2i} + (N_2 - N_3)\frac{5}{2i} + \cdots + (N_{i-1} - N_i)\left(\frac{2i-1}{2i}\right)}{N_o - N_o S} \tag{2}$$

Substituting $N_o(\sqrt[i]{S})^t$ for $N_1, N_2, N_3, \cdots N_{i-1}$, where $t = 1, 2, 3, \cdots i - 1$,

$$p = \frac{(N_o - N_o S^{1/i}) + 3(N_o S^{1/i} - N_o S^{2/i}) + 5(N_o S^{2/i} - N_o S^{3/i}) + \cdots + (2i-1)(N_o S^{(i-1)/i} - N_o S)}{2i(N_o - N_o S)} \tag{3a}$$

$$= \frac{(1 - S^{1/i}) + 3(S^{1/i} - S^{2/i}) + 5(S^{2/i} - S^{3/i}) + \cdots + (2i-1)(S^{(i-1)/i} - S)}{2i(1 - S)} \tag{3b}$$

$$= \frac{(1 - S^{1/i})[1 + 3S^{1/i} + 5S^{2/i} + \cdots + (2i-1)S^{(i-1)/i}]}{2i(1 - S)} \tag{3c}$$

From (3c) can be developed the general equation for the calculation of p.

$$p = \frac{1 + S^{1/i}}{2i(1 - S^{1/i})} - \frac{S}{1 - S} \tag{4}$$

As previously indicated, the calculation of p becomes increasingly refined as i increases. Moreover, p computed as the limiting value as i approaches infinity, can be expressed in the equation

$$p = \frac{-0.4343}{\log_{10} S} - \frac{S}{M} \tag{5}$$

(N.B. $1 - S = M$)

This constitutes a continuous solution for p taking into account the constant effect of M on the population.

As the annual mortality rate decreases, p approaches 0.5 years; however, as the annual mortality rate increases p decreases significantly to less than 0.4 years at an annual mortality rate of 80%. On analysis of the distribution of the recoveries of Robins in the sample used in this study (see Table 4) birds recovered dead may fail to display a uniform monthly distribution. However, until indicative studies are forthcoming, it seems necessary to remain uncertain as to whether such a sample is the result of biassed seasonal recovery as suggested by Lack, or the result of a true seasonal variation in mortality rate, which is highly probable, and which is constant from year to year, or both.

The Relation Between Mean Longevity and Annual Mortality Rate

The reciprocal relation between annual mortality rate (M) and mean longevity (Y) *beyond the selected initial date* in a stable population has been used for calculating each of these from the other. The formula of Burkitt (1926: 97), which is impractical in its original form, and the simplified forms employed by Nice (1937: 191), Farner (1945: 65), Marshall (1947: 194), and Hann (1948: 10), when used to calculate longevity, in reality assume that all birds which die during a given year actually live to the end of that year, or that there is a period which may approximate 0.5 years between the date of hatching and the initial date in which case a *mean total longevity* is calculated for *those alive on the initial date*. The former is readily apparent if an annual mortality rate of 100% were assumed. Then in accordance with the unmodified reciprocal relation,

$$Y = \frac{1}{1.00} = 1 \text{ yr.}$$

Thus, all of the birds would attain the age of 1 year. Therefore, all must die on the last day of the year! The same reasoning, although less obvious, is involved in using this relationship with other mortality rates. Because of the particular dates involved, the calculations presented in the previous paper (Farner, 1945: 66, Table 7) give approximations for the total mean longevity, from the date of hatching, for birds surviving the first November 1, since at that date the birds are approaching 0.4–0.5 years in age. The artificial nature of this application and the restricted conditions thereof make its further usage inappropriate.

Mean longevity (Y), as of the selected initial date (first January 1 in this study), can be calculated from the formula,

$$Y = \frac{1}{M} - (1 - p), \tag{6}$$

where p is the mean period of survival after the first of the year for birds which die during the year. If Lack's assumption of a uniform monthly distribution of deaths is accepted, p is 0.5 years. If a uniform mortality rate is operative throughout the year and if the annual mortality rate is not greater than 50%, p is probably not significantly less than 0.5 years. If p is calculated, maximum accuracy is actually obtained by use of the continuous solution for p equation (5) which substituted in equation (6) gives a simple calculation for Y,

$$Y = -\frac{0.4343}{\log_{10} S} \tag{7}$$

However, if the mortality pattern is known definitely to deviate from that of a uniform rate, p should be calculated directly. For example, if the monthly

pattern of deaths shown by Table 4 is actually unbiassed, p would be 0.34 years. However, until differentiation can be made between true and biassed monthly mortality patterns within the year, it seems advisable to follow Lack's assumption of a uniform monthly distribution of deaths or the assumption of the action of a uniform mortality rate throughout the year providing that the annual mortality rate is not in excess of 50%. Then, in either case the equation becomes

$$Y = \frac{1}{M} - 0.5. \tag{6a}$$

The applicability of this equation is illustrated by using the mortality rate, 52%, from lines 3 and 4 in Table 2, indicating a mean longevity (Y) of 1.4 years compared with the actual mean longevity of 1.3 years and the calculated value of 1.4 years obtained by following Lack's assumption of a uniform monthly distribution of deaths. Assuming the operation of a uniform mortality rate ($p = 0.44$) the calculated Y would be 1.3 years.

The mean longevity, as of the initial date, for Robins is compared with that of some other passerine species in Table 3. Although the calculations in Table 3 are based on a variety of initial dates they are actually quite comparable since all initial dates (except Bourlière, 1947) are well beyond the period of unstable mortality rates between departure from the nest and the first winter, and further since it now appears to be generally true in passerine species that the annual mortality rate and life expectancy beyond this unstable period do not vary appreciably with time. Erickson's calculation (1938: 309) of longevity in a small population of Wren-tits using the original Burkitt formula indicate a total mean longevity of 4.4 years for birds which survive to the first breeding season. By deducting the age at the first breeding season and correcting the Burkitt formula one would obtain a mean longevity of about 3 years as of the first March. On the other hand, the statement (p. 310) that 36% of the adults die each year would indicate a mean longevity of 2.3 years as of the first March. Both calculations ascribe an unusual longevity for such small birds. Further investigations on the population dynamics of this species would be of considerable interest.

The formula, $Y = \frac{1}{M} - (1 - p)$, is particularly useful in instances where mortality statistics are available but in which the ages of the birds at death are unknown.

Monthly Distribution of Deaths

The monthly distribution of deaths, as indicated by recovered birds, is recorded in Table 4. There is a preponderance during the first part of the year over the expected distribution based on the operation of a uniform mortality

rate or the expected distribution based on Lack's assumption of a uniform monthly occurrence. Whether this reflects a true distortion in the mortality curve or, as Lack suggests, a bias in favor of finding dead birds during these months, is not apparent. A comparison of the distribution of deaths among birds between their first and second January firsts to deaths among older birds (lines 1 and 2, Table 4) does not yield a tangible clue. The bearing of this on the value of p, as shown by Table 4, is obvious. This problem of the monthly distribution of deaths through the course of the year deserves careful investigation.

The Use of Birds Recovered by Trapping in the Calculation of Annual Mortality Rate

Plattner and Sutter (1947: 20) have questioned the reliability of samples which combine records of birds recovered dead and birds recovered by trapping. Combining these 2 types of records assumes that death and trapping function at approximately equal rates for all age groups. Their data (p. 21) indicate that the mortality rate calculated from a trapped sample (number of birds in first year after initial date divided by total number in sample) is higher than that calculated from the samples of birds recovered dead. The basic assumption in the calculation of M from a trapped sample is that, were the trapped sample a truly random sample, then in a stable population the birds in their first year after the initial date must be numerically equivalent to the number of deaths, during the preceding year, of birds which had passed the initial date. Hence, dividing the number trapped in their first year after the initial date by all trapped after the initial date should give an annual mortality rate. The results, however, indicate that in trapping there is bias in favor of young birds. An examination of the data on the Robin confirms this suggestion. (Compare rates in Table 2.) Similar data for the Cardinal (*Richmondena cardinalis*) to be published subsequently indicate a similar bias in trapping in this species. Further investigation is needed to determine to what extent bias in trapping may affect the calculation of mortality rate from birds of unknown age, trapped and banded, and subsequently recovered dead.

Loss of Bands

Analyses of the type presented here, as well as those by, among others, Lack (1943*a*, *b*, *c*, *d*), Lack and Schifferli (1948), Marshall (1947), Hann (1948), Bourlière (1947), and Nice (1937), assume that the sample of birds banded as young and recovered dead is typical of the population. This obviously assumes that there is no appreciable loss of bands or if there is, it operates randomly and independently of age. Thus, the chance of loss by an individual is the same regardless of age attained at death. Kortlandt (1942: 178, 201, 205), in a detailed investigation of a colony of European Cormorants in Holland, observed the loss of bands and calculated indirectly that the loss of bands, although conjectural, together with loss account-

able to "accidents" incidental to banding and the wearing of bands, could be as high as 10%. Lockley (1942) has reported the loss of bands, because of wearing, among Manx Shearwaters and Stuart (1948: 198) is of the opinion that this must occur among British Cormorants. Among passerine species, Lovell (1948) has reported the removal of bands by Cardinals and summarizes other published records of such removal. Linsdale's (1949) investigations at the Hastings Reservation indicate that there may be some loss of bands, as a result of wearing, among Brown Towhees and Spotted Towhees. The replacement of worn bands is not an uncommon procedure in the operation of a banding station. Bands which become sufficiently worn to warrant replacement have been carried 3 years or more. Obviously any loss of bands at a uniform annual rate, or at a rate that increases with age, would result in the calculation of an exaggerated mortality rate and too low a life expectancy. Because of limited sizes of samples, the calculations on passerine birds possible at this time usually have little significance beyond the second or third year. It seems unlikely that errors which may be introduced by the loss of bands should be of a magnitude greater than that of other errors inherent in the method. This assumption, however, should be tested by studies directed towards ascertaining the extent to which bands are lost. At least 2 approaches to the problem are apparent. First, some important information could come from large banding operations in the form of data on the length of time between banding and the time when replacement of the worn band is necessary. Second, an index of some significance could be established by banding with 2 bands (1 on each leg or 2 on 1 leg); the index would be the ratio of the number of double-banded birds recovered with a single remaining band to the total double-banded birds recovered with either 1 or 2 bands. This is based on the probability that the 2 bands would be unlikely to wear at the same rate. Data thus obtained should be correlated with the size, and manufacturer's lot, of band. The data would be of increasing importance as studies, of the kind presented here, become more refined with the accumulation of greater numbers of records. Calculations beyond the third year, when errors due to the loss of worn bands might become important, will then be based on significant numbers of records. The necessity, then, of reasonably precise information on band loss is obvious.

Summary

1. At least in studies involving passerine species, it is suggested that calculations involving longevity, mortality rates, etc., using data from banded birds, be based on the first January 1 in the life of the bird as the initial date in accordance with the suggestion of Lack. The data on the American Robin, presented in an earlier paper have accordingly been recalculated and tabulated.

2. In the calculation of mean longevity (Y) from mean annual mortality rate (M) by the use of the reciprocal relation of M and Y in a stable population, Y must be based on the same initial date as used in the original calculation of M. Y is therefore to be defined as the mean longevity *as of the prescribed initial date*. If it is desirable to calculate a *total mean longevity* from birth, for those alive on the initial date, the mean period from hatching to the prescribed initial date must be added to Y. A *true total longevity* from birth *for all birds hatched* is difficult to estimate because of the high and unstable mortality during the first few months after hatching.

3. In the calculation of Y (as of the prescribed initial date) from M it is neces-

sary to correct the simple reciprocal to allow for the continuous action of M throughout the year. This is accomplished in the equation,

$$Y = \frac{1}{M} - (1 - p) \tag{6}$$

where p is the mean period lived during the year in which death occurs.

4. Providing the M is not in excess of 50%, placing p at 0.5 years, as suggested by Lack, approximates a uniform mortality rate. If M exceeds 50%, and a uniform mortality rate is assumed, p should be calculated by applying a monthly (or weekly, for additional refinement) mortality rate as described on page 70. Maximum refinement may be obtained by a continuous solution for p, in which p is computed as the limiting value as i approaches infinity.

$$p = \frac{-\ 0.4343}{\log_{10} S} - \frac{S}{M} \tag{5}$$

If p is thus calculated, rather than obtained by direct observation, a substitution may be made into the equation (6) for the calculation of Y, giving the simple expression,

$$Y = \frac{-\ 0.4343}{\log_{10} S} \tag{7}$$

Actually because of the probability of non-uniform mortality rates within the year, p should, if possible, be obtained from the observed annual mortality pattern and Y, if to be calculated, should be obtained by use of equation (6).

5. Whereas it is true that the simple reciprocal of the mortality rate gives an approximately total mean longevity from birth for those birds alive on the initial date *providing* that the period between hatching and the initial date is a fraction of a year, this is a coincidence operating within restricted conditions in which 1-p approximates the mean period from birth to initial date. Since it does not have general application it is suggested that its use be discontinued.

6. As suggested by Plattner and Sutter for Tits and Nuthatches, there is apparently bias in retrapping Robins; this bias exaggerates the number of young birds with the result that M, when calculated on the basis of the ratio of birds in the first year after the initial date to older birds, is too high.

TABLE 1

Life Expectancy (e) in the American Robin on Successive January Firsts[1]

DESCRIPTION OF SAMPLE		*e* IN YEARS[2]				
Cause of death	Number dead	1st Jan. 1	2nd Jan. 1	3rd Jan. 1	4th Jan. 1	5th Jan. 1
All causes	597	1.3	1.2	1.0	1.0	1.3
Killed by cat	48	1.3	1.1	—	—	—
Shot	51	1.4	1.2	—	—	—
All causes[3]	597	1.4	1.3	1.1	1.1	1.4

[1] Compare with Farner (1945: 69, Table 9). The records used here are the same as in the previous analysis except for birds which were recovered between the first November 1 and the first January 1; also a few records, unusable in the previous analysis, have now been adequately verified and have been included.

[2] In the calculation of *e* in lines 1, 2, and 3, for each Robin recovered dead the time elapsed between the selected January 1 and the date of death (actual date of recovery) was calculated to the nearest month from its card in the files of the United States Fish and Wildlife Service. The expectancy (*e*) for a particular January 1 was then obtained by calculating the mean period from the selected January 1 to the date of death for all birds alive on that January 1. For convenience in comparison with other authors the means were then expressed in years.

[3] Calculated according to the procedure of Lack (1948: 265–266) in which it is assumed that each bird which dies during the year lived for half of the year in which it died; Lack makes this assumption because of the possibility of "seasonal bias in the chances of recovery." Deevey (1947: 284, 295) has also pointed out that *e* may be calculated by use of the formula, $e_x = \frac{T_x}{l_x}$, where T_x is the total individual-years (individuals × years to be lived) as obtained from his "life table" for x years, and l_x is the number of individuals alive at the beginning of the year x. Both Lack and Deevey assume an approximately uniform distribution of deaths through the year; this will be discussed further in this paper.

TABLE 2

Age-Group Composition of American Robins Based on January 1[1]

DESCRIPTION OF SAMPLE	TOTAL ALL AGES	YEAR OF LIFE						RATIO[2] ADULT / YOUNG	S %	M %
		1st	2nd	3rd	4th	5th	6th+			
All recoveries	824	438	204	109	50	13	10	88:100	47[3]	53[3]
Same, in *per cent*	*100*	*53*	*25*	*13*	*6*	*2*	*1*			
Recovered dead	597	291	154	94	40	9	9	See footnote 4	48[4]	52[4]
Same, in *per cent*	*100*	*49*	*26*	*16*	*7*	*1*	*1*			
Recovered alive[5]	217	143	48	15	7	3	1	52:100	34	66
Same, in *per cent*	*100*	*66*	*22*	*7*	*3*	*1*	*1*			

[1] Compare with Farner (1945: 59, 62; Tables 1a, 1b, 4, 5). The records used here are the same as in the previous analysis except for birds which were recovered between the first November 1 and the first January 1; also a few records, unusable in the previous analysis, have now been adequately verified and have been included.

[2] Used in this study as the ratio of birds which on January 1 have attained at least their second January 1 to those which have attained their first January 1. Here, 386:438 = 88:100.

[3] Per cent *per annum* after first January 1, assuming a stable population. Survival rate = 1 − mortality rate. In a stable population the annual mortality rate equals the ratio of surviving first-year birds to the total population, since the number of young surviving from each year (taken in this study as those alive on their first January 1) is equal to the number of second-year and older birds which have died during the year, provided that the mortality rate is the same for each age group.

[4] From mortality rate (1 − survival rate) computed by dividing the total number of deaths (597) by the combined total of birds alive on all January firsts (1148). This is the more accurate method since it takes into account any differential mortality rates that may exist. It is the same method as employed by Lack (1948:266) as expressed by the formula,

$$M = \frac{D_1 + D_2 + D_3 \cdots}{D_1 + 2D_2 + 3D_3 \cdots}$$

where D_1, D_2, D_3, etc., are the numbers of deaths during the first, second, third, etc. years of life respectively. The survival rate would be 51% (mortality rate 49%) if calculated on the same basis as the line above. Compare with Farner (1945: Table 5, p. 62.)

[5] Mostly by trapping.

TABLE 3

Mean Natural Longevity (Y) of Some Passerine Species[1]

SPECIES	NUMBER OF RECORDS	Y IN YEARS	HOW OBTAINED	INITIAL DATE	REFERENCE
American Robin	597	1.3	R	1st Jan. 1	This paper
American Robin	597	1.4	C	1st Jan. 1	This paper
European Blackbird	258	1.9	R	1st Jan. 1	Lack (1946a)
Song Thrush	262	1.55	R	1st Jan. 1	Lack (1946a)
British Robin	130	1.1	C	1st Aug. 1	Lack (1943d)
European Redstart	383	1.1	C[2]	Breeding season	Ruiter (1941)
Song Sparrow	54	2.0	C[3]	April	Nice (1937)
Song Sparrow	54	1.9	R[4]	April	Nice (1937)
Starling (England)	154	1.6	R	1st Jan. 1	Lack (1946a)
Starling (Netherlands)	205	1.5	C[5]		Kluijver (1935)
Starling (Switzerland)	306	1.1	R	1st Jan. 1	Lack and Schifferli (1948)
Oven-bird	38	1.7	C[6]	Breeding season	Hann (1948)
Great Tit	252	1.4	C[7]	1st Nov. 1	Plattner & Sutter (1947)
Great Tit	225	1.1	C[8]	1st Nov. 1	Plattner & Sutter (1947)
Blue Tit	69	1.4	C[9]	1st Nov. 1	Plattner & Sutter (1947)
Marsh Tit	89	1.6	C[9]	1st Nov. 1	Plattner & Sutter (1947)
Rook	121	1.4	R	Departure from nest	Bourlière (1947)

R = mean longevity (Y) obtained by averaging the ages (from initial date) at death of birds banded as young and subsequently recovered dead. C = mean longevity as of initial date calculated from mortality rate (M), $Y = 1/M - 0.5$.

[1] Compare with Farner (1945: 67, Table 8) in which Y is the approximate *total longevity* for individuals alive on the initial date.

[2] From Ruiter's data (1941:204, Table VIII) indicating an annual mortality rate (breeding season to breeding season) of 62%. This agrees with Lack's (1946a:262) interpretation. Ruiter's statement (p. 210), that the mean age attained by young which return to the breeding area is 27 months, excludes birds which die before their first breeding season.

[3] Recalculated from the annual mortality rate (April to April) of 40% "in a well-situated population."

[4] Nice gives her data as of the date of birth for those alive at the beginning of the first breeding season. Here these data have been adjusted, by deduction of 0.8 years (the period between birth and the first breeding season), to give Y (observed) as of the initial date, *i.e.*, the beginning of the first breeding season. Actually Nice's sample contains many birds which were certainly more than a year old at the beginning of the breeding season. Since e does not change appreciably, the value of Y obtained by including these individuals is not

modified appreciably. If the 18 known first-year birds in this sample are used alone, the observed Y as of the beginning of the first breeding season is 1.7 years. This lower value coincides with Nice's statement that these birds were subjected to an unfavorable removal of cover.

[5] Recalculated from the annual mortality rate of 50%. Kluijver's calculation of 3.0 years is total longevity for birds which reach breeding age (1–2 years) and excludes birds which die before this time.

[6] Recalculated from the annual mortality rate (breeding season to breeding season) of 46%. The "mean minimum life span" of 2.2 as calculated by Hann (1948: 6) is not comparable since it is a minimum mean span from birthdate for birds which have survived at least to the first breeding season.

[7] Calculated from the annual mortality rate in a sample of birds banded at unknown ages.

[8] Calculated similarily from a sample of birds banded as young.

[9] Calculated similarily from a mixed sample, *i.e.*, birds banded as young and birds banded at unknown ages.

TABLE 4

Monthly Distribution of Deaths as Indicated by Robins Recovered Dead with Comparisons to Theoretical Distributions Based on Uniform Monthly Distribution of Deaths and on Uniform Monthly Mortality Rate

PERIOD	DESCRIPTION	NUMBER	PER CENT PER MONTH												p[1]
			Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
1st Jan. 1–2nd Jan. 1	Actual recoveries	286	15.0	15.7	9.1	15.0	18.5	11.5	4.2	3.5	2.5	1.7	2.1	1.0	
After 2nd Jan. 1	Actual recoveries	311	10.6	14.5	11.3	16.7	12.2	9.3	8.7	2.6	5.1	2.6	1.3	5.1	
Total after 1st Jan. 1	Actual recoveries	597	12.7	15.1	10.4	15.9	15.2	10.4	6.5	3.0	3.8	2.2	1.6	3.2	0.34
Total after 1st Jan. 1	Theoretical, uniform monthly distribution[2]		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	0.50
Total after 1st Jan. 1	Theoretical, uniform monthly mortality rate[3]		11.4	10.8	10.0	9.5	8.9	8.5	7.9	7.3	7.0	6.7	6.2	5.8	0.44

[1] p = mean period lived after January 1 of year in which death occurred.

[2] See Lack (1948: 265–266).

[3] Based on annual mortality rate of 52% (or annual survival rate of 48%), calculated using the formula, $p = \frac{-0.4343}{\log_{10} S} - \frac{S}{M}$.

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DEPARTMENT OF ZOOLOGY, STATE COLLEGE OF WASHINGTON, PULLMAN, WASHINGTON

TWENTY-FIVE EGGS APPARENTLY LAID BY A COWBIRD

LAWRENCE H. WALKINSHAW

WHILE working with the Eastern Field Sparrow (*Spizella pusilla*) during the past few years I have had opportunity to observe some of the habits of the Eastern Cowbird (*Molothrus ater*). During the summer of 1944, I estimated by censusing the number of birds in the flocks on the area, that 5 pairs of Cowbirds were breeding on a 100-acre census area in Pennfield Township, Calhoun County, Michigan. I spent a total of 242 hours on this area from March through July 27. As the summer advanced I became aware of the similarity among the Cowbird eggs laid in the nests of a certain section of the 100 acres and a small area to the north and east. These eggs were shaped alike, were about the same size, and were almost identical in color, being spotted much less than the usual Cowbird egg. I found 25 of them and, of this number, I knew the exact date of laying of 19 and the date within 1–2 days for 4 others. No 2 were laid on the same day. The first was laid in a nest of the Towhee (*Pipilo erythrophthalmus*) on May 15 and the last in a Field Sparrow's nest, probably on July 20, a period of 66 days. The Cowbirds were not banded but the similarity of the eggs and the fact that they were laid on different days helped confirm my opinion that 1 female laid all 25.

In Table 1, I have listed the dates the eggs were laid and, following this, more detailed notes on the 21 nests parasitized by, apparently, the 1 Cowbird. The territory in which the eggs were laid was a roughly triangular area of about 12.5 acres, 321 feet along the west side, 972 feet from northwest to southeast, and 1,288 feet along the south side. It consisted of open shrubby fields covered sparingly with trees and a small cut-over, burned-over woodlot, with many small shrubs. It included the territories of at least 3 pairs of Towhees, 3 or 4 pairs of Vesper Sparrows (*Pooecetes gramineus*), and 16 pairs of Field Sparrows. One nest of a Towhee was parasitized and 20 nests of 14 pairs of Field Sparrows (9 pairs: 1 nest each; 4 pairs: 2 nests each; 1 pair: 3 nests). The eggs were laid in the early morning, before 5 or 6 a.m. Usually eggs of the host species were removed in the early morning, but one was taken between 7 a.m. and 8 p.m.

The average measurement of 11 of these Cowbird eggs was 21.8 x 16.9 mm and the average weight 3.18 grams. The extremes in length were 21.4 to 22.1 mm and in width, 16.4 to 17.1 mm—a remarkable similarity in size. The extremes in weight were 3.0 and 3.3 grams when fresh. A statistical analysis of these 11 eggs and of 22 other Cowbird eggs showed that for the 11 eggs the mean length was 21.8 $\pm$ .20 mm and the mean weight was 3.18 $\pm$ .10 gms.

For the 22 other eggs the mean length was 22.7 ± .81 mm and the mean weight was 3.16 ± .17 gms. A comparison of the standard deviations by the F ratio method showed that the variability in length differed significantly in the 2 samples but the variation in weight did not differ significantly.

The Towhee and 15 of the Field Sparrows deserted their nests when the Cowbird laid eggs and removed the host eggs. Two parasitized nests were

TABLE 1

Data on Cowbird Eggs Apparently Laid by One Female

DATE LAID	HOST	NEST	HEIGHT	EGGS OF HOST	
				Laid	Disappeared
May 15	Towhee		on ground	3	2
May 16	"		" "		
May 20	Field sparrow	1	22 cm.	1	1
Found	" "	2	on ground	?	?
May 25	" "	2	" "		
May 26	" "	3	18 cm.	0	0
May 29	" "	4	on ground	1	1
May 30	" "	5	" "	3	2
June 5	" "	6	" "	4	(4 yg.)
June 7	" "	7	22 cm.	1	1
June 10	" "	8	on ground	3	1
June 11	" "	8	" "		
June 13	" "	9	27 cm.	1	1
June 18	" "	10	12 cm.	1	1
June 19	" "	10			
June 22	" "	11	on ground	3	0
June 23–24	" "	12	13 cm.	4	3
June 30	" "	13	12 cm.	2	1
July 8	" "	14	41 cm.	2	1
July 11	" "	15	27 cm.	3	1
July 10–12	" "	16	40 cm.	?	?
July 14	" "	17	42 cm.	2	1
July 16	" "	18	34 cm.	2	1
July 17	" "	19	25 cm.	2	1
July 20?	" "	20	25 cm.	3	0
May 15–July 20		21		41	23

destroyed by unknown agencies. In 3 nests, young were raised; 1 of these was a nest in which the young were 6 days old when the Cowbird egg was laid.

The following additional notes were made at the nests:

Towhee Nest. Built May 11 to 13. Towhee eggs laid May 14, 15, and 16. Cowbird eggs laid May 15 and 16, before 6 a.m. Two Towhee eggs were missing May 16. One of these was lying about a foot from the nest with a bill hole through the side. Nest deserted.

Field Sparrow Nests. 1. Built May 13 and 14. First Field Sparrow egg laid May 19, before 7 a.m. On May 20 at 7 a.m. this egg was gone and a Cowbird egg was present. Nest deserted. Female Field Sparrow 140–32215.

2. Found May 25 with 2 Cowbird eggs. Nest deserted. The female on this territory unbanded.

3. Female Field Sparrow unbanded (male 140–87740). Nest built May 24 and 25. On May 26 it contained a Cowbird egg and was immediately deserted. The female Field Sparrow started a new nest, which I found May 28, and she laid an egg when it was barely started. She finished building the nest, covering her own egg, then laid another egg May 31, but the egg was destroyed by some unknown agency during the day.

4. Female 140-87741 building nest May 25 and 26. One Field Sparrow egg laid May 27 was gone May 28. Apparently the Cowbird egg was laid May 29. I observed it early during the morning of May 30. Nest deserted.

5. Female 140-32203 building nest May 26. Nest completed May 27. No eggs on May 28. Not visited May 29. On May 30 the nest contained 1 Field Sparrow egg and 1 Cowbird egg, both newly laid. On May 31 the second Field Sparrow egg was laid and on June 1, the third, between 5:15 and 7:00 a.m. Two Field Sparrow eggs disappeared June 4. Nest deserted.

6. Female 140-32208. Nest found May 23 with 4 Field Sparrow eggs. Three hatched on June 2, the fourth on June 3. On June 5 the young were gone. A Cowbird egg had been laid in the nest.

7. Female Field Sparrow, 140-32206, building nest June 5. On June 6 at 7 a.m. it contained 1 Field Sparrow egg. At 7 p.m. this egg was gone, but on June 7 at 6 a.m. it contained a Cowbird egg. Nest deserted.

8. Female Field Sparrow, 140-32202, found building nest June 9. On June 10 the nest contained 1 Field Sparrow and 1 Cowbird egg. On June 11 the first Field Sparrow egg was gone; a second Field Sparrow egg and a second Cowbird egg had been laid. A third Field Sparrow egg was laid June 12. On June 13 these eggs had been destroyed by some unknown agency.

9. Nest built (Female 140-32204) June 8 and 9. First Field Sparrow egg laid June 12. On June 13 at 6 a.m. this egg was gone and a Cowbird egg had been laid. Deserted.

10. Female Field Sparrow, (140-32214) found building nest June 15. On June 16 it was nearly completed. First Field Sparrow egg laid June 17. On June 19 this nest contained 2 Cowbird eggs. The Field Sparrow egg was gone. Nest deserted.

11. Nest found June 5 with female 41-120060 sitting on three eggs. Two hatched June 16, and a third June 17. With 3 young in the nest 5 and 6 days old, the Cowbird laid an egg June 22, in the early morning. The young left the nest the same day.

12. Nest built June 15 and 16 by female 140-87741. First Field Sparrow egg laid June 17; fourth on June 20. All 4 eggs were in the nest on June 22. In the early morning of June 25, the nest was found deserted. It contained 1 Field Sparrow egg and 1 Cowbird egg, both damp with dew. The Cowbird egg had been laid June 23 or 24.

13. Completed nest built by female Field Sparrow 140-32214, found June 28. First Field Sparrow egg laid June 29, 5:30 a.m. On June 30 at 6 a.m. the first egg was gone and a second Field Sparrow egg and a Cowbird egg had been laid. The female was sitting on the nest. She did not desert these eggs, but the nest was destroyed by some predator July 16.

14. Female 140-32205. Nest found with one Field Sparrow egg July 7. This marked egg was gone July 8 but a second Field Sparrow egg and a Cowbird egg had been laid. Nest deserted.

15. Female 140-32213. Found July 8 when empty and not yet completed. On July 10 at 7 a.m. it contained 1 Field Sparrow egg. At 7 a.m. on July 11 the first egg was gone and a second Field Sparrow egg had been laid, as well as a Cowbird egg. At 7 a.m. July 12, the third Field Sparrow egg had been laid. On July 17 the Cowbird egg was found on the ground beneath the nest. Two young Field Sparrows hatched July 24 and left July 31.

16. Female 140-32205. This female was observed regularly July 9 to 12 in this area but I did not find the nest until July 13. It contained 1 Cowbird egg. From observations at other nests, the nest must have been built July 9 to 10 and the Cowbird egg laid July 10 to 12. The Field Sparrow had moved to a new location and built another nest in which she deposited her first egg July 13 (nest 17). The Cowbird egg was deserted.

17. Female 140-32205. Nest found July 13 in the early morning with 1 Field Sparrow egg. On July 14 at 7 a.m. it contained 2 Field Sparrow eggs and 1 Cowbird egg. The first-laid Field Sparrow egg had a bill hole in it. Nest deserted July 15.

18. Female 41-120060. Completed nest found July 13. At 7 a.m. July 15 it contained 1 Field Sparrow egg. On July 16 at 8 p.m. it contained a second Field Sparrow egg and 1 Cowbird egg; the first marked Field Sparrow egg was gone. Nest deserted.

19. Female 140-32228. Fully constructed nest found July 13. On July 15 at 7 a.m. it contained 1 Field Sparrow egg. At 8 p.m. July 16 this egg was gone, but a second Field Sparrow egg had been laid. At 7 a.m. July 17 it still contained the second Field Sparrow egg and a newly-laid Cowbird egg. Nest deserted.

20. Nest found July 18. First Field Sparrow egg laid July 19. When revisited in the early morning July 24, it contained 3 Field Sparrow eggs and 1 Cowbird egg. Apparently no Field Sparrow egg was removed. The female, 41-73350, hatched only 1 young, on August 2. This young Field Sparrow left the nest about August 9. I removed the Cowbird egg July 24 to keep it with a number of similarly-marked eggs taken from the above deserted nests. It was the only Cowbird egg I found on this particular area during the summer that might have been successful. It was the only one with which I interfered.

Summary

From May 15 to July 20, 1944, 25 Cowbird eggs were laid, apparently by one female, on a 12.5 acre area in Pennfield Township, Calhoun County, Michigan. It was concluded that the eggs came from the same female because (1) they were very similar in coloration (2) no 2 were laid on the same day (3) the length of 11 similarly colored eggs had significantly less variability than the length of 22 not-similarly colored eggs.

The eggs were laid in a nest of a Towhee and in 20 nests (belonging to 14 pairs) of Field Sparrows. Three or 4 pairs of Vesper Sparrows also nested on the area but apparently were not parasitized.

Cowbird eggs were laid in relation to the laying of the first egg of the host as follows: 2 before the host had laid any eggs; 2 were laid the same day; 11 on the day after; 4 on the second day after (2 of these being second Cowbird eggs for the same nest). One Cowbird egg was laid 3–4 days after the completion of the host's clutch; one was laid when the host's young were 3 days old, and one when the host's young were 6 days old. In 1, possibly 3, parasitized Field Sparrow nests no Field Sparrow eggs were laid.

At least 17 Field Sparrow eggs and 4 young (in 16 nests) and 2 Towhee eggs (in 1 nest) disappeared from the nests, presumably removed by the Cowbird (2 eggs were found with bill holes in them). From 3 nests no egg was removed.

Eggs disappeared from the hosts' nests in relation to the laying of the first Cowbird egg as follows: 3 the day before; 7 eggs and 4 young on the same day; 3 eggs on the day after. From 1 nest 3 host eggs disappeared 5 days after the Cowbird egg was laid. Excluding from consideration the nest in which a Cowbird egg was laid when the host young were ready to leave, 15 out of 20 parasitized nests were deserted. In 1 nest the Cowbird egg was found on the ground below the nest 6 days after it was laid.

1703 Central Tower, Battle Creek, Michigan

MORTALITY OF BIRDS AT THE CEILOMETER OF THE NASHVILLE AIRPORT

WALTER R. SPOFFORD

THE purpose of the following account is to record the apparently singular circumstances surrounding an accident to a migratory flight of birds at the ceilometer at the Nashville Airport. During the second week of September, 1948, numerous reports appeared in the press of substantial numbers of birds killed at various locations from New York to Texas. In at least several of the instances, the accidents were typical in that the wave of birds collided with an obstacle, as at the Empire State Building in New York. In an account of the Empire State occurrence, Pough ('48) attributes the accident to the fact that the bird flight was riding a southward moving mass of cold air, and that the latter was continuously being pressed to a lower altitude by an overlying northward moving mass of warmer air. At New York City the flight was sufficiently low to strike the shaft of the world's tallest building.

Presumably, similar conditions may have been operative at a number of eastern seaboard locations, such as at the 491 foot Philadelphia Savings Fund Building and the 450 foot WBAL television tower in Baltimore, on the same evening (Sept. 10–11, 1948). At Nashville, however, on the preceding night, Sept. 9–10, the birds fell to the ground while flying across the vertical beam of light sent up from the ceilometer and apparently death was due to impact with the ground or runways. Although it may be reasonable to assume that the birds crossing the beam of light were temporarily blinded and hence fell to their deaths hundreds of feet below, the actual combination of circumstances responsible for the accident is a mystery, because the ceilometer has been in use at Nashville for years with no previous known effect on migrating birds, and furthermore such ceilometers are in use at other airports.

The instrument in question, made by the Crouse-Hinds Company of Syracuse, New York, sends a vertical beam from a mercury-vapor lamp of great intensity high into the sky, recording cloud levels up to 15,000 feet, and is said to be visible from 30,000 ft. At Nashville it is set in a low, brick housing on the airfield close to the runways. The beam of the light may be seen at night as a narrow, blueish column, and on cloudy nights the light spot it makes on the clouds can be seen from several miles away. The caretaker of the light, Mr. Charles Linville, stated that at close range the light is so intense as to blind for several hours anyone so unfortunate as to look directly into it, and that it can cause third degree burns. However, if the intensity falls off as the inverse square, it is doubtful that such effects can be considered important factors in arresting a bird flight hundreds of feet in the air overhead. Pre-

sumably in a period of several years birds must have passed over the ceilometer on numerous occasions and apparently without effect. On the morning of Sept. 10, however, between midnight and 4:30 A.M., some 300 birds fell down the column of light, to be picked up dead (for the greater part) or variously incapacitated on the ground.

The accident was reported to the Nashville Children's Museum by Mr. Skinner of the airport staff, and the actual observation was made by Mr. Linville. On the night in question, at 6:30 P.M. of Sept. 9, the weather record shows that the cloud ceiling was at 2400 ft., the ground visibility 6 miles, a 4 mph NW wind, and a temperature of 67°F. At 11:30 P.M. the ceiling had lifted to 4200 ft., and visibility increased to 10 miles, with wind and temperature about the same. At this time birds were first noted going overhead (reported as various calls, including a "honking" sound (Green Heron?)). An hour later when the first birds began to fall, the ceiling was at 5000 ft., gradually lifting to 9700 ft. at 4:30 A.M., when the last birds fell. Most of the birds fell in the first hour. Mr. Linville stated that as he looked up the shaft of light, as far up as he could see, birds were tumbling down to land on the ground and adjacent runway, mostly dead. He watched for over an hour, but when Pied-billed Grebes and an American Bittern appeared overhead he took shelter. In the morning he gathered 248 birds which were taken to the Nashville Children's Museum for study by Mrs. Amelia Laskey and the writer. Mr. Albert Ganier later prepared a few of the specimens for his private collection. Before the main group of birds was taken to the museum, however, some dozens of badly damaged birds were swept off the runways, and not recorded.

It is clear that with the atmospheric conditions reported, there can hardly have been any considerable factor of poor visibility, and in fact it would seem none at all. There had been cloudy and unsettled weather with small amounts of precipitation from Sept. 3 through the 9th, but the morning of the accident brought clearing. Since the beam of light was not directed at any object except the clouds thousands of feet overhead, there can have been no appreciable factor of flying toward the beam. Rather, only those birds actually crossing the beam were intercepted. It is not impossible that, becoming aware of the light below, birds started downward towards it, and becoming incapacitated, fell to their death. It is noteworthy that most fell within 50 to 100 ft. of the instrument, but some were found at somewhat greater distances. The slight N to NW wind tended to carry birds to the south side of the impact area, but a considerable number was on the north side as well. This might suggest that they fell from no great height, but Mr. Linville stated that he thought that he could see them at least a 'thousand' feet up. Since it is doubtful just how far the smaller birds at least could be seen under such conditions, 500 ft. may be a more reasonable estimate, and of course birds may have entered the column of light at various altitudes. This is low, however, in terms of the heights recorded

Record of Birds Killed at Nashville on the Night of Sept. 9–10 and at the Empire State Building on the Following Night

SPECIES		NASHVILLE	NEW YORK
Pied-billed Grebe	(Podilymbus podiceps)	6	0
American Bittern	(Botaurus lentiginosus)	1	0
Sora Rail	(Porzana carolina)	2	0
Empidonax Flycatchers		20	0
Yellow-bellied	(Empidonax flaviventris)	19*	
Acadian	(Empidonax virescens)	1*	
Wood Pewee	(Contopus virens)	5	0
Olive-backed Thrush	(Hylocichla ustulata)	2	0
Veery Thrush	(Hylocichla fuscescens)	2	1
Yellow-throated Vireo	(Vireo flavifrons)	1	0
Red-eyed Vireo	(Vireo olivaceus)	95	8
Black and White Warbler	(Mniotilta varia)	9	7
Prothonotary Warbler	(Protonotaria citrea)	2	0
Worm-eating Warbler	(Helmitheros vermivorus)	0	1
Blue-winged Warbler	(Vermivora pinus)	0	1
Tennessee Warbler	(Vermivora peregrina)	7	3
Nashville Warbler	(Vermivora ruficapilla)	1	1
Yellow Warbler	(Dendroica petechia)	4	0
Magnolia Warbler	(Dendroica magnolia)	5	7
Cape May Warbler	(Dendroica tigrina)	0	3
Black-throated Blue Warbler	(Dendroica caerulescens)	0	6
Cerulean Warbler	(Dendroica cerulea)	1	0
Blackburnian Warbler	(Dendroica fusca)	1	0
Chestnut-sided Warbler	(Dendroica pensylvanica)	3	3
Bay-breasted Warbler	(Dendroica castanea)	0	5
Black-poll Warbler	(Dendroica striata)	0	4
Prairie Warbler	(Dendroica discolor)	1	1
Oven-bird	(Seiurus aurocapillus)	6	16
Northern Water-thrush	(Seiurus noveboracensis)	7	5
Louisiana Water-thrush	(Seiurus motacilla)	2	0
Kentucky Warbler	(Oporornis formosus)	9	0
Connecticut Warbler	(Oporornis agilis)	0*	10
Mourning Warbler	(Oporornis philadelphia)	4*	0
Yellow-throat	(Geothlypis trichas)	4	4
Yellow-breasted Chat	(Icteria virens)	20	5
Wilson's Warbler	(Wilsonia pusilla)	1	0
Canada Warbler	(Wilsonia canadensis)	20	1
Redstart Warbler	(Setophaga ruticilla)	4	6
Bobolink	(Dolichonyx oryzivorus)	1	1
Baltimore Oriole	(Icterus galbula)	1	3
Rose-breasted Grosbeak	(Pheucticus ludovicianus)	0	1
Savannah Sparrow	(Passerculus sandwichensis)	1	0
		248	103

* Tentative identification.

by the ingenious method of Carpenter (1906); but the observation of Stone (1906) recorded a flight passing quite low over the lumber yard fire he described.

On the other hand, the observation showed that the birds did not fly either into the light or into the ground, but were arrested high in the air, to fall to the ground with death by impact. It is interesting that both legs of the bittern were broken by the fall, but the heavy-bodied grebes were not badly damaged. Overing (1936) mentions that during one night flight at the Washington Monument, many sparrows appeared at the ground, flying down and apparently resting from the flight, but no such factor was apparent at the Nashville flight. Although it is clear that a major role was played by the ceilometer light, it is equally clear that other and unknown factors were operative, because of the fact mentioned that similar occurrences have not been noted at Nashville before, and that similar instruments are in operation at many or most other airports.

In the accompanying table are recorded the birds of the Nashville group and also the birds from the Empire State Building in New York, supplied through the kindness of Mr. Pough. In each case the list is incomplete, and while the Nashville list probably contains by far the greater percentage of the total killed, there is no such assurance for the New York group, where it may be supposed that a much larger proportion was lost.

The imposing group of warblers is not a complete representation of the flight, as a short field trip later in the day revealed 2 Golden-winged Warblers as well as several Yellow-throated Vireos. It does not seem possible to allocate the Nashville birds to any one origin, as both 'Canadian' and 'Carolinian' forms are represented. Wilson's Warbler, Canada Warbler and Northern Waterthrush are matched by Yellow-breasted Chat, Cerulean, and Kentucky Warblers. It is interesting that the Empire State group contains 5 Yellow-breasted Chats. Overing (1936, 1937, 1938a, b) has provided a well worthwhile record of birds killed at the Washington Monument. Of 874 warblers of 22 species picked up in three seasons, 347 (39%) were Yellow throats, 181 (21%) were Magnolias and 94 (11%) Black-throated Green. Not a single Canada Warbler appeared in that list, while at Nashville 18% were of this species. Since the Nashville group is from a single flight it is not as significant as the substantial sample published by Overing, but the considerable differences in the proportions of various species are worth noting. The presence of rails, grebes, and a bittern at Nashville indicates a wider representation of families, but whether this is due to differences in the collection of the sample, to real differences in fly-way cross-section, or merely to fortuitous factors, is not apparent.

Summary

On the morning of September 10, 1948, approximately 300 birds were killed or incapacitated at the ceilometer of the Nashville Airport, and 248 of these were studied at the Nashville Children's Museum. The occurrence appears

to be unique in that the birds did not collide with some object while in flight, but were intercepted upon crossing the vertical beam of the ceilometer light, down the long narrow column of which they fell, to be picked up dead, presumably from impact with the ground. The light itself is not a sufficient cause of the accident, as it has been in use for years without incident, and other such instruments are in use at other airports. Furthermore, visibility was high and the cloud level was at 5000 ft. or above during the accident. The actual combination of factors responsible remains a mystery.

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VANDERBILT MEDICAL COLLEGE, NASHVILLE, TENNESSEE

THE EFFECT OF AGE ON LAYING DATES, SIZE OF EGGS, AND SIZE OF CLUTCH IN THE YELLOW-EYED PENGUIN

L. E. RICHDALE

IN THE twelve-year period from August 1936 to May 1948 I have carried out a banding study of the Yellow-eyed Penguin, *Megadyptes antipodes*, on the Otago Peninsula, New Zealand. In the course of this study it has been possible to note the behaviour of 162 young penguins from the time when they entered the water as fledglings until they disappeared from my field of operations. The age of individuals under review varied from 1 to 11 years with only 2 birds attaining the age of 11 years. It is obvious, therefore, that by the time the study ended several of the penguins had become aged. Nevertheless, for the purpose of this paper all birds whose age is known are considered 'young penguins.' In addition to the 162 young penguins whose date of hatching could be determined there were also under observation 298 other young penguins which were banded in their first year. It was unknown when and where these juvenals were hatched but as all eggs of the Yellow-eyed Penguin are normally laid within a space of approximately 3 weeks in any one season, the age of these young birds is therefore known to within 3 weeks.

From the study of the behaviour of 460 young penguins in relation to their age, much information has evolved relative to the influence of age on breeding biology. In this paper only 3 aspects will be considered: (1) the influence of age on laying dates; (2) the influence of age on size of eggs; and (3) the influence of age on size of clutch.

Two terms need defining. (1) From the time when a young penguin enters the sea as a fledgling until it moults into its first adult plumage such a bird will be known as a *juvenal*. This period varies from approximately 14 to 18 months. The juvenals are easily recognised by the lack of a sulphur-yellow band of feathers across the back of the head as obtains in adults. (2) In the period between the first and the second adult moults, the penguins will be described as *two-year-olds* and so on for succeeding age-groups.

An outline of the annual cycle of the Yellow-eyed Penguin has already been published (Richdale, 1941). Briefly, the cycle is as follows: Towards the end of August the penguins begin to spend much time ashore in the daytime preparatory to egg-laying. From the middle of September to early October all eggs that are to be laid that season will appear. Since incubation lasts approximately 42 days, by the end of the third week in November practically all chicks which are to hatch, have hatched. For approximately 8 weeks the chicks are continuously guarded by each parent in turn but after that the chicks are left unguarded in

the daytime. Towards the end of February the chicks gradually enter the water and approximately 2 weeks after that, on the average, the parents begin their annual moult. One month previously, on the average, however, juvenals and adults which have not been feeding chicks pass through their moult. In the winter months this species of penguin does not migrate but tends to spend part of its time on the breeding grounds in the evening and during the night. It is at this period that the majority of the new pairs for the ensuing season are formed.

Age of Bird and Laying Dates

As the years of the research passed by and as more and more females of known age laid for the first time, it became obvious that age had no influence whatsoever on the date of laying of any particular female. To test the matter statistically the relative data have been tabulated in Table 1. Young birds laying for the first time totalled 59 individuals made up of 34 two-year olds, 23 three-year-olds,

TABLE 1

A Comparison of Laying Dates of Females Laying for the First Time and of Older Females of Unknown Ages

TYPE OF BIRD	NUMBER OF EGGS	MEAN DATE, SEPTEMBER	STANDARD DEVIATION IN DAYS	STANDARD ERROR IN DAYS
Young	104	26.06	5.70	.56
Age unknown	100	27.45	5.37	.54

and 2 four-year-olds. The 52 older birds were of unknown age because they were already adults when first banded. The dates of egg-laying used for these older birds are those when the individual bird was either last seen in its place of breeding or else in the twelfth year of study. This means that the birds ranged in age from at least 7 years to at least 14 years when the data concerning them were taken.

Of the 104 eggs laid by the young birds, 45 females produced 2 eggs and 14 females only 1 egg. Of the 100 eggs laid by older birds, 48 females produced 2 eggs and 4 females only 1 egg. Had these single eggs in both groups of birds been excluded the mean laying dates of the 2 sets of birds would have been much closer but even so the difference as it stands is not statistically significant. From more than 700 records of laying dates in twelve years, the earliest laying date for a young bird is 11 September and the latest is 12 October. For an older bird the earliest laying date is 13 September and the latest is 15 October but the latter date is not included in the data in Table 1 because the laying date of a later season has been used for the particular female penguin concerned.

Age of Bird and Size of Eggs

In Table 2 are given details of egg weights at various ages from 2 to 11 years of age. In some instances the number of eggs weighed has not yet reached an adequate sample, especially for the later years, but the investigation is still continuing. All eggs were weighed shortly after being laid. As the figures stand for first and second eggs laid by two-year-olds there is no significant difference, but the sample is small.

It is interesting to note that three-year-old females laying for the first time do not produce eggs lighter than those by three-year-olds which had already laid as two-year-olds. As two-year-olds lay eggs which are significantly ($P < .005$) smaller than those produced by both types of three-year-olds, it is

TABLE 2

A Statistical Comparison of Weight of Eggs at Successive Ages of Females

TYPE OF EGG	NUMBER OF EGGS	MEAN	STANDARD DEVIATION	STANDARD ERROR
		grams	*grams*	
First egg of two-year-olds	34	115.12	6.06	1.04
Second egg of two-year-olds	19	118.68	7.86	1.85
All eggs of two-year-olds	53	116.39	6.61	0.91
Eggs by three-year-olds laying for first time	47	130.04	5.70	0.83
Eggs by three-year-olds laying for second time	42	131.36	7.74	1.19
All eggs of three-year-olds	89	130.66	6.41	0.68
All eggs of four-year-olds	64	135.31	5.46	0.68
All eggs of five-year-olds	40	137.07	7.29	1.14
All eggs of six-year-olds	29	136.69	7.80	1.44
Eggs by birds 7 to 11 years old	35	139.91	7.91	1.34
Eggs by other birds 8+ to 14+ years old	100	139.19	10.17	1.02

obvious that age is the main factor in the smallness of the eggs laid by two-year-olds and that if two-year-olds do not lay until a year later they are physiologically able to lay eggs as large as those females which have already laid as two-year-olds.

On comparing the three-year-olds and the four-year-olds it may be observed that egg weights increase still further significantly but between successive years no significant increase is registered again. If, however, the four-year-olds are compared with the grouped ages from seven to eleven years another significant difference seems apparent. This means that by the age of four years the egg weights have almost reached their maximum and that over a course of several years a slight significant increase may possibly obtain. More data are required to say exactly when the increase ceases and when, if any, there is a decline in weight due to age.

As a further check, statistics from 100 eggs laid by birds whose ages ranged

from at least 8 years to at least 14 years were worked out. When compared with these, the eggs laid by four-year-olds indicated a significant difference but those laid by five-year-olds did not so that egg weights, on the average, probably reach their maximum when the females are in their fourth and fifth years.

In Table 3 statistical data for the length of the egg have been worked out in the same way as for the weight in Table 2. An endeavour has been made also

TABLE 3

A Statistical Comparison of Length of Eggs at Successive Ages of Females

TYPE OF EGG	NUMBER OF EGGS	MEAN	STANDARD DEVIATION	STANDARD ERROR
		mm.	mm.	
First egg of two-year-olds	34	74.7	3.36	.58
Second egg of two-year-olds	19	76.6	2.57	.59
All eggs of two-year-olds	53	75.4	3.28	.45
Eggs by three-year-olds laying for first time	47	76.5	2.02	.29
Eggs by three-year-olds laying for second time	42	76.1	2.34	.37
All eggs of three-year-olds	89	76.3	2.17	.23
All eggs of four-year-olds	64	76.7	2.63	.33
All eggs of five-year-olds	40	76.2	1.93	.31
All eggs of six-year-olds	29	76.5	1.75	.32
Eggs by birds 7 to 11 years old	35	76.7	1.95	.33
Eggs by old birds 8+ to 14+ years old	100	76.0	2.64	.26

to discover if there are any significant differences in the various age-groups for lengths but in no instance is any difference significant. It is noticeable, however, as far as the study has proceeded, that in eggs laid by two-year-olds there is a greater spread of egg lengths which lessens with age. With birds in the group at least eight years old and more the length again becomes irregular, suggesting an interesting problem to investigate when penguins of a known age become older.

An examination of the data relative to the width of eggs (Table 4) reveals a situation comparable to that for weights with the exception that the difference in egg-width between the four-year-old birds and those birds for the group from 7 to 11 years old is not quite significant statistically. The above means therefore that there are 3 significant differences for egg-width involving the same age-groups as for weights. These are (1) birds 2 years old lay narrower eggs than birds 3 years old and older (2) birds 3 years old lay narrower eggs than those 4 years old and older (3) birds 4 years old apparently lay slightly narrower eggs than birds of age ranging from at least 8–14 years.

Two other points are of interest. (1) Between three-year-olds laying for the first time and those three-year-old birds which laid as two-year-olds there is, as with weights, no significant difference in their egg-width. (2) The differ-

ence in egg-width between the four-year-olds and the last 2 age-groups mentioned in Table 4 is not quite significant for the group from 7–11 years but the difference is significant for birds at least from 8–14 years old. This information suggests that birds may lay slightly wider eggs after 4 years of age, but, as with the data for weight, more details are required for definite decisions.

TABLE 4

A Statistical Comparison of Width of Eggs at Successive Ages of Females

TYPE OF EGG	NUMBER OF EGGS	MEAN	STANDARD DEVIATION	STANDARD ERROR
		mm.	mm.	
First egg of two-year-olds	34	53.31	1.49	.26
Second egg of two-year-olds	19	53.34	1.46	.33
All eggs of two-year-olds	53	53.32	1.48	.20
Eggs by three-year-olds laying for first time	47	55.95	0.94	.14
Eggs by three-year-olds laying for second time	42	56.36	1.17	.18
All eggs of three-year-olds	89	56.15	1.08	.12
All eggs of four-year-olds	64	56.98	1.14	.14
All eggs of five-year-olds	40	57.52	1.37	.22
All eggs of six-year-olds	29	57.25	1.35	.25
Eggs of birds 7 to 11 years old	35	57.75	1.35	.23
Eggs of old birds 8+ to 14+ years old	100	58.05	1.59	.16

TABLE 5

Age in Relation to Size of Clutch

	AGE OF BIRD IN YEARS				
	2	3	4	5–10	7–14
Number of females	40	53	39	63	63
Number of eggs	67	104	78	124	123
Mean eggs	1.68	1.96	2.00	1.97	1.95

Age of Bird and Size of Clutch

The normal clutch size for the Yellow-eyed Penguin is 2 eggs. In collecting data for this investigation I have included only those clutches from breeding areas in which I was working frequently in the period when the eggs were being laid. It is not safe to wait until the eggs have been incubated for a time for, in the interval since the eggs were laid, a number certainly disappear for various reasons.

Table 5 lists 258 females and the number of eggs laid by them according to age. All records were taken soon after the eggs were laid. Of 40 two-year-olds, 13 (32.5%), laid only 1 egg to the clutch; of 218 older penguins, 7 (3.2%) as far as I could ascertain, laid only 1 egg to the clutch. A further point of interest is that of 31 three-year-olds which did not lay as two-year-olds, only

1 bird failed to produce the normal complement of 2 eggs to the clutch. Of an additional 22 three-year-olds which had already laid the previous season as two-year-olds, only 1 did not produce 2 eggs. As this bird suddenly changed its mate (a most unusual happening) some 2 weeks before laying, my impression was that this unusual procedure was the cause of the single egg to the clutch. Further, the egg did not hatch.

Discussion

As for other species of birds not much information is available relative to the effect of age on laying dates, size of eggs, and size of clutch. In connection with the effect of age on laying dates Nice thinks (1937: 106) that in the Song Sparrow, *Melospiza melodia*, the earliest sets of eggs are laid by adult birds and that the young females probably lay later. She also quotes authors who indicate that in the Starling, *Sturnus vulgaris*, and in the Grey Heron, *Ardea cinerea*, old birds tend to lay earlier than young females.

Further evidence on the matter under discussion is as follows: From 9 January to 26 February 1948 I spent 48 days on the sub-Antarctic islands, The Snares, which are situated some 64 miles south-west off the end of the most southerly of the 3 main islands of New Zealand. Among other things it was possible to study the laying period of Buller's Mollymawk, *Diomedea bulleri*. Females of this species began to lay on 16 January and had almost completed laying for the year when we left on 26 February so that the span of laying is approximately 7 weeks. A total of 132 eggs was weighed and measured (only 1 egg forms the clutch). There was no tendency for large eggs to be laid first and for smaller eggs to appear later. All sizes were scattered indiscriminately throughout the entire laying period. Therefore, if my surmise is correct that young birds in Buller's Mollymawk lay small eggs, age is not a factor in determining laying dates of individuals in that species.

In conclusion, it would seem that in penguins and petrels which tend to have restricted laying spans and which tend to breed at a relatively late age, that age does not affect the date of laying. Age at breeding in species of petrels which I have studied has varied from the end of the second year as in the Diving Petrel, *Pelecanoides urinatrix*, to as long as the end of the eighth year as in the Royal Albatross, *Diomedea epomophora sanfordi*. It should be noted, however, that all species of penguins and petrels may not have a restricted laying period. For example, from my own observations the Little Blue Penguin, *Eudyptula minor minor*, has a laying span of several months.

In species of birds like the Song Sparrow which may breed more than once in a season and may re-nest if a nest is destroyed, it is possible that the breeding rhythm in young females has not developed fully by the time the old birds are ready to reproduce early in the season. This would mean that young females would tend to lay subsequently to the older females which had bred previously.

In connection with the effect of age on size of eggs it is well known that the young birds of the domestic fowl produce small eggs. Nice (1937: 113–121) in her study of the Song Sparrow indicates a comparable situation to that which obtains in the Yellow-eyed Penguin. For example, in the Song Sparrow, egg-width and egg-weight increase with age, being 3 % for width and 7% for weight; egg-length is variable. Reduced egg-width and consequently reduced egg-weight would seem to be governed in young birds by the lack of a fully developed oviduct due to youth.

As for the effect of age on size of clutch in birds in general, some information is available in the literature but, although probably many of the statements are valid, little statistical support is offered. Nice (1937: 108–111) and Lack (1947: 313–314) summarise the known data and opinions. Much more research is needed. In the Yellow-eyed Penguin, as already noted, two-year-old birds definitely tend to produce a clutch less than the normal complement of 2 eggs. After that, unless advanced age has an influence, age does not affect size of clutch. In conclusion, it may probably be found that young birds of many species tend to produce small clutches. As regards aged birds, the position is somewhat doubtful and may not be so general. Lack (1947), for instance, quotes species which are apparently not affected.

Summary

In the course of a 12-year study (1936-48) of the Yellow-eyed Penguin, *Megadyptes antipodes*, it was possible to study the effect of age of bird on laying dates, size of eggs, and size of clutch.

From 104 eggs laid by 59 young penguins which laid for the first time the mean date of laying was 26.06 September; from 100 eggs laid by 52 older birds the mean date of laying was 27.45 September. The difference is not significant statistically. In practice eggs laid by young penguins may appear at any time in the short laying period of approximately three weeks—age does not affect date of laying.

Two-year-old Yellow-eyed Penguins produce significantly lighter and narrower eggs than older birds but although the difference in length is not significant, individual measures are dispersed over a wide range. Three-year-olds lay much heavier and wider eggs than two-year-olds but not so heavy nor so wide as do four-year-olds. Subsequently there is possibly a further slight significant increase in width and weight. In old age there appears to be a tendency towards a reduction in weight and towards irregularity in length but width of eggs seems to increase.

Of 40 two-year-old Yellow-eyed Penguins, 32.5% laid only 1 egg to the clutch whereas of 218 older birds only 3.2% did so. Youth, therefore, in this species, does affect size of clutch.

In Buller's Mollymawk, *Diomedea bulleri*, age does not appear to affect date of laying.

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DEPARTMENT OF ZOOLOGY, UNIVERSITY OF OTAGO, DUNEDIN, NEW ZEALAND.

THE SNOWY OWL MIGRATION OF 1946–47

Third Report of the Snowy Owl Committee

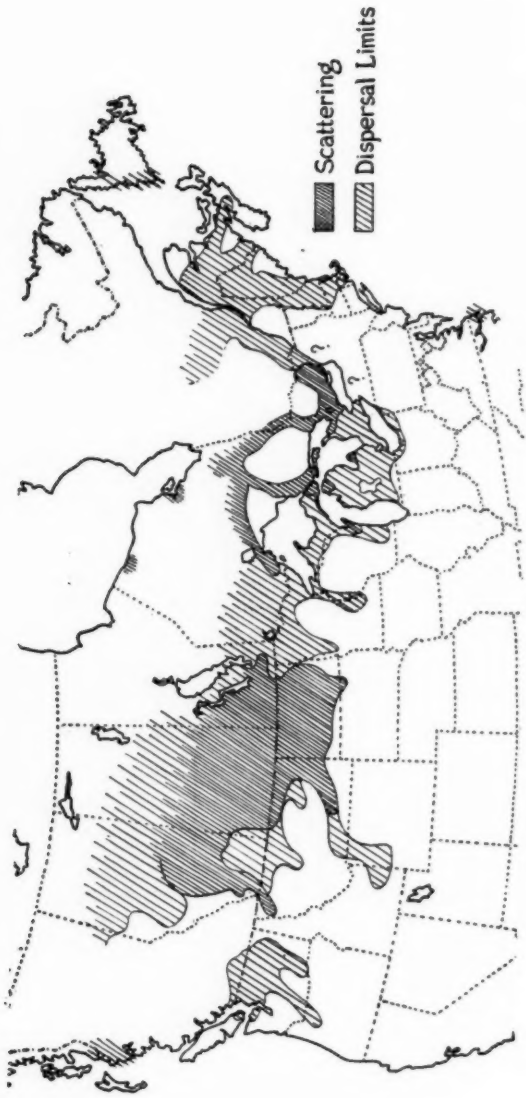
L. L. Snyder

REPORTS on two major migrations of Snowy Owls (*Nyctea scandiaca*) have been made by the Committee. The first (*Wilson Bull.*, **55:** 8–10) concerned a flight in the autumn and winter period of 1941–42. The source of this flight was the eastern Arctic and its spread largely involved southeastern Canada and the northeastern and north-central United States. Occurrences in the Prairie Provinces during the period probably represented a more or less regular winter population, not an excessive influx. Sources which provide information annually on the status of certain birds indicated an inconspicuous repetition-flight of Snowy Owls in the east during the autumn of 1942 but nothing noteworthy in the west. The minor movement in the east was considered too insignificant to warrant a full scale Committee survey and report. Presumably, the basic condition for any Snowy Owl flight in the east, or an excessive influx in the west, is an unbalance in the Arctic between the owl population and its food supply. It would therefore be expected that a repetition or "echo" flight would follow a major flight in the succeeding year if unbalance still existed. A relatively small number of owls involved in an echo flight could be accounted for either by a depletion of the owl population, or by improvement in its food supply in the Arctic, or both.

The second report of the Committee (*Wilson Bull.*, **59:** 74–78) concerned the major flight of 1945–46. Again, the source of the flight was largely the eastern Arctic, from the Boothia Peninsula eastward through Baffin Island and northern Ungava. There was some evidence of a precursory population rise of Snowy Owls on Victoria Island and at the western end of Coronation Gulf but it was not general through the western Arctic as it was in the east. The 1945–46 flight was a major one, apparently the largest on record. Its spread involved both the east and the west with heavy concentrations in suitable areas in the former region and a heavy influx and broad scattering in the latter.

The present report and map concern the flight of the following year, the autumn and winter of 1946–47. In the east this flight was a mere echo of the migration of the previous year. For example, in Ontario occurrences approximated only 13% of the volume for 1945–46, in Michigan about 7.5%, in Ohio about 2%, and in Maine and Massachusetts little more than 1%. However, scattering carried representatives as far south as North Carolina where two were observed in the Pea Island area of Dare County.

Because of the general rarity of occurrence of Snowy Owls in the east during



Extent of Snowy Owl Migration of 1946–47

the autumn–winter period of 1946–47 it has not been possible clearly to trace the course of the flight and time its progress. Therefore, it is uncertain whether the birds which appeared in the east emanated from the eastern Arctic where the population was known to be currently low, or from the western Arctic where the population was at a peak. Very few records were received from the Province of Quebec and there was but one each from New Brunswick and Nova Scotia. Of the few owls reported from Newfoundland it was suspected that some had remained over the summer from the flight of the previous year. The comparatively weak flights in other eastern Provinces and States have already been noted. The earliest observation of a Snowy Owl in Ontario was made in September at Lake Nipissing. The first reported in a more southerly locality in Ontario was observed at Toronto on October 3. In Michigan the earliest report concerned one observed in the east-central part of the state (Lapeer County). Most of the subsequent early October reports came from the western half of the Upper Peninsula. The few records from Ohio indicated a November entry there, apparently via both the east and west ends of Lake Erie. It has not been possible to obtain precise information relative to occurrences in New York State.

The situation was markedly different in the west. It should be recalled that a heavy influx occurred in the west, as in the east, the previous year. It became evident in October 1946 that another heavy flight was under way. Many observers in settled portions of the Prairie Provinces and in North Dakota considered the flight to be as large or larger than the previous year. This opinion is substantiated by census figures for the Prairie Provinces where the total of Snowy Owls reported for 1946–47 was approximately 47% higher than for 1945–46.

Because observers are rather sparsely distributed and there are unavoidable imperfections in practicable means of gathering data in the west, little more than a general impression of such a flight can be given for this vast region. Probably there were no conspicuous lines of flight or marked concentrations, scattering being the rule for ecological reasons. Although the total of owls observed, the number killed, the time of first occurrence, and the period of largest numbers for particular sections cannot be precisely presented for the west, we have the broad picture of a repetition flight the year succeeding a major flight, becoming conspicuous in central portions of the Prairie Provinces from early to mid-October. By the end of that month, forerunners occurred in North Dakota, Montana, Washington, and southern British Columbia and by early November individuals had reached northern South Dakota (Columbia), southwestern Idaho (Bingham County) and northwestern Oregon (Scio). By December the impetus of the flight was spent and the number of Snowy Owls in the northwestern tier of States was at a maximum. Relatively fewer Snowy Owls are killed in the west, than in the east.

The migration was not conspicuously evident in the midwestern and north-central United States. No Snowy Owls were reported to the Committee from Indiana, Illinois, or Iowa. Only a few were observed in Minnesota, the first at Duluth on October 5th. The first record for Wisconsin was for September in the central northern part of the State (Vilas County). Opinion in that State considers that the principal port of entry was in the northeast via the upper peninsula of Michigan from whence migrants spread south along the Lake Michigan shore, and west along the south shore of Lake Superior, thence down the Mississippi.

The general picture of density and distribution in the north-central United States suggests that Snowy Owls entered the region from the northeast, i.e. from east-central Ontario, and from west of the Great Lakes, presumably from Manitoba. It is not altogether clear whether Snowy Owls passing south through east-central Ontario came from the east or west of Hudson Bay. The largest concentration of Snowy Owls reported (approximately 100 in October) from a restricted locality was at Attawapiskat Post halfway up the west coast of James Bay. This report suggests that Snowy Owls may have followed the coast line eastward from the west side of Hudson Bay and thence southward.

Undoubtedly, the flight of 1946–47, which was pre-eminently a western event, had its origin principally in the western Arctic. Arctic stations reporting a high population of Snowy Owls for the period immediately preceding the flight are situated from Holman Island (off western Victoria Island) eastward to Repulse Bay and south through Baker Lake to Eskimo Point on the west coast of Hudson Bay. No information on the status of Snowy Owl populations in Alaska is available. The owl population was low in the eastern Arctic. Extreme southeastern occurrences of Snowy Owls during the 1946–47 flight may be interpreted as peripheral scattering of the flight from the western Arctic, or the result of a weak echo-flight of the decimated eastern Arctic population. It is evident, within the experience of this Committee, that heavy incursions in the east depend on an exodus of a peak population in the eastern Arctic. There seems no reason to suppose that any heavy periodic influx of Snowy Owls in extreme eastern North America has its origin in the western Arctic though a notable influx in the west may result from an exodus of a peak population in the eastern, or western, Arctic. Consequently, it is unlikely that a heavy flight of Snowy Owls in New England reflects conditions in animal populations west of Hudson Bay.

Members of the Committee: Roy N. Bach, Wm. B. Barnes, Irven O. Buss, C. T. Black, W. J. Breckenridge, B. W. Cartwright, J. D. Cleghorn, Alfred O. Gross, Lawrence E. Hicks, C. M. Kirkpatrick, Gordon M. Meade, J. A. Munro, Harold S. Peters, T. M. Shortt, R. W. Tufts, Willet N. Wandell, Leonard Wing, J. Van Tyne, L. L. Snyder, Chairman.

Royal Ontario Museum of Zoology, Toronto 5, Ontario

THE *ORNITHOGRAPHIA AMERICANA* OF FATHER PLUMIER, 1689–1696

FRANÇOIS BOURLIERE

FATHER C. Plumier was a noted pioneer of West Indian botany. Between 1689 and 1696, he undertook 3 successful expeditions in the West Indies, visiting various islands such as Martinique, Saint Domingue (now Haiti),

Green Heron. Pen and ink drawing of Father Plumier. Plate 87 of his unpublished *Ornithographia Americana*. Courtesy Museum National d'Histoire Naturelle, Paris.

Saint Vincent, Bequia, Saint Christophe, Santa Cruz and Saint Thomas. Most of the botanical results of these expeditions were published in a series of famous books: *Description des plantes de l'Amérique avec leurs figures*, 1693; *Nova plantarum americanarum genera*, 1703; *Traité des fougères de l'Amérique*, 1705 and *Plantarum americanarum fasciculus primus* [*-decimus*] . . ., 1755–1760. These beautiful books are especially noteworthy for their plates engraved after the field-sketches of the author. But Father Plumier, like many old-style naturalists, was not solely interested by plants and, during his travels, made numerous sketches of birds, mammals, fishes and various invertebrates. These unpublished drawings are now preserved in the central library of the Museum National d'Histoire Naturelle in Paris. Among them, a beautiful collection of ornithological plates, bound in a folio volume bearing the number Ms 27 and entitled *Ornithographia americana*, s worthy of interest for ornithologists.

Through the kindness of Madame G. Duprat, librarian of the Museum National, I have been able to examine at length these drawings and, with the help of Mr. J. Berlioz, curator of the ornithological department of the same institution, I succeeded in identifying most of the birds figured. Most of the drawings are water-colors probably made in France after the field-sketches preserved in a second volume (Ms 29) and bearing numerous notations on the color of the plumage and soft parts of the birds. Other drawings are exact pen and ink replicas of the original sketches.

Some of the birds are unusually lively, e.g. the Green Heron of the plate 87 here reproduced, and suggest that they were sketched from life. A few plates are very careful anatomical drawings, e.g. plates 91 to 93, while a lot are mere "stuffed" pictures, probably drawn from dead birds. A few birds cannot be identified, the sketches being unfinished or lacking in precision. Also, some birds pictured are unquestionably composite ones (plates 71 and 94), drawn from memory or after freakish descriptions of some settlers.

A good deal of these drawings are completed by manuscript notes giving vernacular (French and Carib) names and some peculiarities of the birds pictured.

The following 68 species may be easily identified.

Colymbus dominicus (pl. 59)
Podilymbus podiceps (pl. 60)
Puffinus lherminieri (pl. 27), with egg.
Phaëthon aethereus (pl. 34, 35). Plumier notes that this bird was observed by him "apud insulam Martinicanam".
Pelecanus occidentalis (pl. 91 to 93)
Fregata magnificens (pl. 7 and 36). Plumier observed this bird forcing boobies to disgorge fish.
Casmerodius albus (pl. 80 and 85)
Florida caerulea (pl. 77 and 78). Plumier figures the adult and the immature birds.
Butorides virescens (pl. 83 and 87)
Nyctanassa violacea (pl. 81 and 86)
Ixobrychus exilis (pl. 84)
Plegadis falcinellus (pl. 75)
Guara alba (pl. 76).
Ajaia ajaja (pl. 95)
Phoenicopterus ruber (pl. 96)
Buteogallus anthracinus (pl. 4), seen by Plumier in Union Island, Grenadines.
Falco sparverius (pl. 5 and 6)
Aramus guarauna (pl. 82)
Porphyrula martinica (pl. 65 and 66)
Gallinula chloropus cerceris (pl. 69 and 70)
Fulica caribaea (pl. 68)
Jacana spinosa (pl. 73 and 74)
Haematopus ostralegus (pl. 88). In his notes, Plumier describes the peculiar feeding behavior of this bird. He said he never observed it elsewhere than in the Grenadines.
Charadrius vociferus (pl. 63)
Capella gallinago (pl. 61)
Totanus melanoleucus (pl. 90)
Erolia minutilla (pl. 65)
Himantopus himantopus (pl. 89)
Larus atricilla (pl. 30)
Sterna dougallii (pl. 31 and 32)
Sterna fuscata (pl. 28). Plumier figures the egg and describes the nest. He said that an important nesting colony was then located at "Le diamant" (Diamond Rock) near Martinique. [James Bond suggests that this may be *S. anaethetus*. Editor]
Anoüs stolidus (pl. 29)
Columba squamosa (pl. 23)
Columbigallina passerina (pl. 25)
Oreopeleia chrysia (pl. 24)
Coccyzus minor (pl. 14). Said to exist in St. Domingue and Tortuge Island.
Saurothera longirostris (pl. 12 and 13). Said to be common at St. Domingue.

Crotophaga ani (pl. 19). Observed in St. Domingue. "Gregarim vivunt", said Plumier.

Tyto alba (pl. 8 and 9). Observed only at St. Vincent.

Speotyto cunicularia (pl. 10). Named by Plumier Ulula cunicularia or Chevèche lapin. The burrowing habits of this owl are well described in manuscript notes as well as the bird's amusing habit of bobbing up and down when alarmed.

Chaetura sp. (pl. 38)

Eulampis jugularis (pl. 41)

Orthorhyncus cristatus (pl. 40)

Temnotrogon roseigaster (pl. 16 to 18). St. Domingue.

Todus angustirostris (pl. 42). Said to live "apud insulam Sandominicarum". [*T. subulatus?*]

Centurus striatus (pl. 14)

Tyrannus dominicensis (pl. 46)

Progne subis dominicensis (pl. 38)

Corvus leucognaphalus (pl. 58). St. Domingue.

Mimocichla ardosiacea (pl. 51)

Cichlherminia l'herminieri (pl. 52)

Myadestes genibarbis dominicanus (pl. 47)

Dulus dominicus (pl. 63)

Coereba flaveola (pl. 41)

Dendroica erithachorides rufigula (pl. 39)

Dendroica discolor (pl. 42)

Seiurus aurocapillus (pl. 43)

Quiscalus lugubris (pl. 53)

Icterus bonana (pl. 39)

Phaenicophilus palmarum (pl. 43)

Saltator albicollis (pl. 50)

Loxigilla violacea (pl. 50).

Among introduced species, the following were observed by Plumier between 1689 and 1696:

Ortalis ruficauda (pl. 57). Said to be very common in St. Vincent and Grenadines. The species was certainly introduced very early and was already naturalized at the end of the seventeenth century.

Crax alector (pl. 54 and 55), *Icterus jamacai* (pl. 44) and *Rhamphastos erythrorhynchus* (pl. 15) were undoubtly pictured after cage birds. For the last species, Plumier notes that this bird is not indigenous in the West Indies.

8 Rue Huysmans, Paris 6, France

GENERAL NOTES

BIRD NOTES FROM NORTHERN MICHIGAN

In a recent paper (1948) I have detailed in part the results of a wildlife survey of the Huron Mountain district, Marquette County, Michigan, made from October 1939 to July 1942. Included therein are a description of the area and an inventory of its vertebrate fauna, among which are listed 206 species and subspecies of birds, with only the briefest of notes appended. Certain additional data of special interest as well as Huron Mountain records of some forms not to my knowledge previously published are presented. Mentioned in the present notes are 29 species.

Common Loon. *Gavia immer.*—This is a common summer resident, and pairs may be found on most of the inland lakes. On June 25, 1940, I located a nest containing 3 eggs (2 is the usual number) on a small island in Howe Lake. On June 26, 1942, at Mountain Lake I observed 2 chicks riding on the parent's back. From July to October groups of from 2 to 6 loons are frequently seen on Lake Superior, near the shore, usually in early morning or evening.

Blue Goose. *Chen caerulescens.*—Bayard H. Christy has told me that 2 geese, seen on the Cranberry Marsh by Herbert E. Perkins in May 1926, were accurately described as this species.

American Pintail. *Anas acuta.*—This species has been reported once in the Huron Mountains, on September 28 (probably since 1930), by B. H. Christy.

Gadwall. *Anas strepera.*—S. Morris Pell observed 1 of these ducks on Howe Lake on September 2, 1941.

Wood Duck. *Aix sponsa.*—This species continues to breed in limited numbers in the Huron Mountains. In 1941 there appeared to be at least 2 broods on the Salmon Trout River. A downy juvenile, probably not over a week old, was taken in a weir by F. Wallace Taber on June 2, 1941. On 2 other occasions from then until June 25, 1941, Wood Ducks were captured in this weir—once an adult together with 5 young.

Canvas-back. *Aythya valisineria.*—I observed a flock of 30 flying southward in V-formation over Mountain Lake in the late afternoon of October 9, 1941.

Old-squaw. *Clangula hyemalis.*—I observed one of these ducks over Conway Bay on February 1, 1941.

White-winged Scoter. *Melanitta fusca.*—On January 25, 1940, I saw a pair about 200 yards from shore, at the edge of the ice on Lake Superior, near West Flat Rock. Again, on May 16, 1940, I observed 1 male and 3 females resting on the water of Conway Bay.

American Merganser. *Mergus merganser.*—A few winter in the Huron Mountains. On November 20, 1939, and for about a month thereafter, a flock of more than 200 was congregated on the south bay of Rush Lake; over 75 per cent of them were males. After May 31, broods were frequently encountered, numbering from 6 to 14. On June 10, 1942, I observed a female swimming on Mountain Lake, with 7 young on her back.

Bald Eagle. *Haliaeetus leucocephalus.*—Usually at least 1 pair nests in the region each year. Near West Flat Rock, in the summit of a large white pine about 100 yards from the Lake Superior shore, was an aerie which had been used for several years. On July 8, 1940 (as seen with binoculars from a boat) there was 1 young bird in this nest, and another trying its wings on a nearby branch; 1 adult perched in a neighboring tree top, while another flew along the shore. On July 9, 1941 2 birds were seen in this nest, at least 1 of them apparently an adult. Another aerie has been reported, in years past, on Conway Point; immature eagles were seen in flight near here on June 15, 1941 and again on June 7, 1942.

Sharp-tailed Grouse. *Pedioecetes phasianellus.*—This bird is a recent arrival in the Huron

Mountain region. Baumgartner (1939) stated that the first authentic record in the Upper Peninsula of Michigan was in 1922, and that the species appeared to be "spreading eastward on a broad front extending from Lake Superior to Lake Michigan." I noted 1 in a cutover area on Salmon Trout Point on November 10, 1939; B. H. Christy saw 1 near the town of Big Bay on July 3, 1941, and S. M. Pell saw 1 on May 26, 1942.

Upland Plover. *Bartramia longicauda.*—I observed a single bird on September 24, 1941, in a grassy clearing among jack pines between Pine Lake and Lake Superior.

Greater Yellow-legs. *Tringa melanoleuca.*—S. M. Pell saw 1 on Third Pine Lake on October 5, 1941.

Ruddy Turnstone. *Arenaria interpres.*—B. H. Christy observed 1 on the Lake Superior beach near the mouth of Pine River from the last week of August until September 13, 1937. I noted 1 at the same spot on October 5, 1941.

Pectoral Sandpiper. *Erolia melanotos.*—S. M. Pell noted 1 at the Cranberry Marsh on October 5, 1941.

Red-backed Sandpiper. *Erolia alpina.*—B. H. Christy and I observed 1 on the shore near the outlet of Ives Lake on October 13, 1939.

Wilson's Phalarope. *Steganopus tricolor.*—A bird, seen at about noon near the eastern Huron Islands by S. M. Pell and me on July 9, 1941, was believed to be this species.

Yellow-billed Cuckoo. *Coccyzus americanus.*—One bird, which I preserved, was found dead at the Anne Lake landing on the west shore of upper Mountain Lake on October 4, 1940.

Snowy Owl. *Nyctea scandiaca.*—Mrs. Carroll Paul reports that 1 was shot at the Ives Lake Farm in the winter, about 1937. David M. Nason tells of seeing 1 near the Five Forks on January 26 and again on April 5, 1940. Several were reported seen, and 1 killed, at the town of Big Bay in November 1941.

Great Gray Owl. *Strix nebulosa.*—B. H. Christy reported seeing this bird repeatedly, and in successive years, on the upper reaches of Pine River from about 1900 to 1905.

Richardson's Owl. *Aegolius funerea.*—One bird was collected "in the late fall in the woods between Rush Lake and Lake Superior" (Gregory, 1929). This specimen was taken about 1910 by Hans Jensen and given to H. E. Perkins, who had it mounted; it is now in the collection of the University of Michigan Museum of Zoology.

Saw-whet Owl. *Aegolius acadica.*—One specimen was collected by D. M. Nason at his home a few miles southeast of Big Bay on February 23, 1941; it is in the collection of the University of Michigan Museum of Zoology. B. H. Christy reported seeing and hearing 2 of these owls in woods south of Pine Lake on July 12, 1941.

Chimney Swift. *Chaetura pelagica.*—H. Emerson Tuttle, in 1936, located a hollow nesting tree along the Trout Lake trail; debris and egg shells a foot deep outside the tree indicated long occupancy. Leopold (1939) mentioned "one bird found in a hollow basswood near Trout Lake, May 31, 1938." B. H. Christy once found a nest in a boathouse cubicle near the mouth of Pine River.

Rough-winged Swallow. *Stelgidopteryx ruficollis.*—B. H. Christy and I observed several at the Ives Lake Farm in the early evening of July 12, 1940, in company with Barn Swallows and Chimney Swifts. I observed the species again over the Cranberry Marsh on July 12, 1941; B. H. Christy has also seen it at the dam on the Salmon Trout River.

Raven. *Corvus corax.*—Ravens are moderately common permanent residents of the Huron Mountains, but no nest has yet been located, to my knowledge. On September 19, 1940, near Ives Mountain I witnessed the masterful aerial performance of a Raven; with wings partly closed it went into a steep dive, then executed a twist and pulled out of the dive, sometimes upside down, on extended wings. This performance was repeated several times by the Raven, while another hovered in the air nearby.

Eastern Winter Wren. *Troglodytes troglodytes.*—This is a common summer resident, but

seldom remains after mid-October. I observed a straggler on January 13, 1940, very active among brush piles and windfalls near a dense cedar swamp on the West Flat Rock trail.

Blue-headed Vireo. *Vireo solitarius.*—This uncommon summer resident is usually seen among jack pines; I noted it on 5 occasions, in jack pines and in mixed hardwood-hemlock stands. On July 9, 1940, in low bushes among maples and hemlocks on the shore of Rush Lake (nearly a mile from the nearest jack pines), I observed an adult feeding 2 young out of the nest. The fledglings were just beginning to fly and were able to perch on low shrubs.

Eastern Cowbird. *Molothrus ater.*—This bird is a rather common summer resident in the Huron Mountains. B. H. Christy noted young Cowbirds out of the nest, and being fed by a Myrtle Warbler, on July 17, 1941; S. M. Pell again observed a Myrtle Warbler feeding young Cowbirds on August 1, 1941.

Greater Redpoll. *Acanthis flammea rostrata.*—One male which I collected at the Oscar Webster homestead on January 30, 1941, was identified by Pierce Brodkorb as this subspecies.

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RICHARD H. MANVILLE, Department of Zoology, Michigan State College, East Lansing, Michigan.

THE VERNACULAR NAME OF THE BALTIMORE ORIOLE

Erroneous statements concerning the vernacular name of the Baltimore Oriole (*Icterus galbula*) have been printed so often in the last half century that it seems worthwhile to assemble the scattered proofs of their errors. Various of the statements appear in such widely circulated works as Mabel Osgood Wright's "Birdcraft," 1895: 172–173; Neltje Blanchan's "Bird Neighbors," 1897: 212; E. H. Forbush's "Birds of Massachusetts," II, 1927: 444; "Birds of America," edited by T. Gilbert Pearson, 1936, II: 260–261, and Malcolm MacDonald's "Birds of Brewery Creek," 1947: 111.

The statements—sometimes presented as tradition, sometimes as fact—are that George Calvert, the first Lord Baltimore, visited Chesapeake Bay in 1628, saw the bird for the first time, and was so pleased by it that he adopted its colors as his own; that colonists who came to Maryland with Cecil Calvert, the second Lord Baltimore, misnamed the bird "oriole"; and that Linnaeus named the species from skins, and named it Baltimore Oriole because its colors were those of the Calverts.

The errors in those stories are shown by historical and ornithological works as follows: A formal "exemplification," or statement, of the Calvert family coat of arms was issued in England in 1622 (1) and this document, a possession of the Maryland Historical Society in Baltimore, shows that the Calvert colors had already been established as "or and Sables"—that is, gold and black. It was not until 1625 that George Calvert became the first Lord Baltimore (2) and not until 1629 that he visited the Chesapeake (3). Cecil Calvert never visited America (4). Thus it is certain that the Baltimore colors were not adopted from the bird, and that Cecil has no part in any tradition.

It is as certainly true, on the other hand, that the bird was named after the Baltimore

colors. Linnaeus, however, was not the first person to so name it. Initially, in the tenth edition of "Systema Naturae," 1758, I: 108, he himself named it *Coracias Galbula*. Only in the twelfth edition, 1766, I: 162, did he rename it *Oriolus Baltimore*. Already 100 years before that, the colonists in America were calling it "the Baltimore bird." Nathaniel Shrigley's "A True Relation of Virginia and Maryland," London, 1669 (5), contains a reference (p. 4) to "the Baltenore bird, being black and yellow"—the name there marred by an "n" for an "m"; the Calverts themselves at that period sometimes spelled their title "Baltemore" (6). John Lawson (7), mentions "the Baltimore-Bird, so called from the Lord Baltimore, Proprietor of all Maryland" (p. 152 of reprint). Likewise, Catesby (8) called it the "Baltimore Bird" and explained: "It is said to have its name from the Lord Baltimore's coat of arms." The "Systema Naturae" indicates, and hence the American Ornithologists' Union (9) considers that it was not from skins but from Catesby's book that Linnaeus included the bird in his classification, and from Catesby that he adopted the species designation *Baltimore*.

As for the "oriole" part of the vernacular name, it was the ornithologists, and not the lay colonists, who made this mistake. To the colonists the bird was simply the "Baltimore bird." Catesby, however, giving the first naturalist's description of it in Latin, termed it an *icterus*, which was the Latin name for the birds that Europeans later came to call orioles. Linnaeus, relying on Catesby's description, in 1758 classified it along with the European birds in *Coracias*, and then in 1766 separated this whole group as *Oriolus*. And down to 1785 *Oriolus Baltimore* stayed strictly a technical name. Only in that year, it seems, was this translated into the English "Baltimore Oriole," by Thomas Pennant (10). And only after that name had become firmly attached were our birds discovered to be only superficially like the "true" orioles of Europe.

To sum up, what can be accurately said about the origin of the name "Baltimore Oriole" is that the designation "Baltimore" became attached, because the bird's colors were those of the Calverts, soon after these proprietors began colonizing Maryland (their first colonists landed in 1634; and Shrigley's "True Relation" shows that in 1669 the name was being used). This designation the ornithologists adopted from the colonists. The ornithologists also for a time regarded the bird as congeneric with the European orioles, and before they changed their view the term "oriole" had become fixed in vernacular usage.

For access to, and help in using, some of the ornithological works cited I am greatly indebted to Dr. John W. Aldrich and Allen J. Duvall.

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HERVEY BRACKBILL, 4608 Springdale Avenue, Baltimore 7, Maryland.

BIRDS FEEDING ON EUROPEAN CORN BORER IN NEBRASKA

While surveying and collecting European corn borers in the vicinity of corn borer parasite release points in eastern Nebraska during October and November 1948, the writer noted that considerable numbers of infested corn stalks bore typical woodpecker punctures. The first

of these was noted October 13 at Fontanelle, Nebraska where two stalks were found that showed bird work. On October 22, 25, and 27 more than 30 stalks were examined just south and west of Fremont, Nebraska. Likewise on October 28 and November 4 a number of bird beak punctures were noted in corn stalks on the University of Nebraska Experiment Farm east of Lincoln. On October 23, while surveying counties where the corn borer had not previously been recorded in Nebraska, two similarly punctured corn stalks were found four miles east of Hebron in Thayer county.

No borers were found in any of the above stalks (more than 50 examined) that had been worked by the birds, indicating that they were successful in taking the borers. The punctures in the stalks were all of the same type. No woodpeckers were noted working on corn stalks, but on two different occasions Hairy Woodpeckers (*Dendrocopos villosus*) were seen along the edge of borer-infested corn fields. This bird predation was noted in eastern Nebraska the second year after the establishment of the European corn borer in the state. The borer apparently was also preyed on the first year it was recorded as common in Thayer county in south-central Nebraska.—Clarence A. Sooter, Department of Entomology, University of Nebraska, Lincoln, Nebraska.

THE STUDY OF HAWKS IN FLIGHT FROM A BLIMP

The Tide Water Associated Oil Co. granted the Urner Ornithological Club the use of their advertising blimp on Sept. 21, 1948 to assist in studying the migration of the Broad-winged Hawk (*Buteo platypterus*) over New Jersey. The day chosen was clear with a 10 mph northwest wind and a temperature of 65°F. A total of 2,150 Broadwings were observed from the ground during the day chiefly from a vantage point in Upper Montclair. It was more difficult to locate the birds from the air than from the ground. Although 1800 hawks were spotted from the ground while the blimp was in the immediate vicinity, only 290 were spotted from the blimp. Radio communication from the airship to ground observers is recommended.

Observations made on only 1 day may not represent average behavior, even though the ground observers in this case described the day as a normal, good day for a Broadwing flight. The height at which the blimp found kettles, that is, a flock of hawks spiraling upward, was, in 4 cases, 1500, 2000, 2700, and 2400–2900 feet above sea level. These hawks were above a valley of 190 feet elevation and rising to fly over a ridge of 590 feet elevation. It is not known that these were the highest kettles of the day, nor measured at their highest point except for the 2000 foot kettle. Although earlier ground estimates had placed the kettles at greater heights, the maximum height reached may well be only 3000 feet, and many times the birds abandon their upward spiraling and "peel off", or enter their straight, downward glide, at only 2000 feet.

The birds peeling off from the 2000 foot thermal, a rising column of air heated from a warmer ground area, were successfully followed until they roosted in trees 4 miles away at a ground elevation of about 450 feet. Thus the ratio of glide to fall was about 12 to 1. The air speed of the Broadwings in the glide was 32 mph in one measurement and 26 mph in another. Judged by the criterion that the hawks were not frightened if they continued their glide in an undeviating line, the birds did not seem to mind the airship provided it was more than 300 feet distant.

Earlier ground observations, in addition to overestimating the height reached in the thermals, were unable to judge accurately airspeeds and distances of glide. Complete details of the undertaking may be found in "The Urner Field Observer", **3** (5–6): 2–9 1948. Further observations from a blimp appear to be a profitable method of obtaining new information on behavior of hawks in flight.—E. I. Stearns, 92 Farragut Road, Plainfield, New Jersey.

SOME WHISTLING SWAN OBSERVATIONS IN WESTERN ALASKA

Herbert W. Brandt (Alaska Bird Trails, 1943: 325) stated that Whistling Swans (*Cygnus columbianus*) were rare in the Hooper Bay region during the summer of 1924. Through the efforts of the Alaska Game Commission much greater protection has been given the species in recent years. Due to this protection and the decreased shooting by Eskimos, the species has increased a great deal during the past decade. Henry Kyllingstad, teacher at Mountain Village on the lower Yukon from 1942 through 1948, stated that he had seen a remarkable increase while he was there.

On an hour trip at Bethel June 4, 1946, I observed 2 swans just north of the village. On an all-day hike June 5, 1946, at Johnson River I flushed 15 swans, all feeding on lakes southwest of our cabin. They were in pairs except for 1 individual. They were on the move at 3:24 a.m., 5:05 a.m., 5:22 a.m., and 5:35 a.m. Their calls resembled "O-o-o-o-o-oa" or "Goo-oo-oo-a". When they rose from the water the pounding of their wings on the surface was plainly audible from .50 to .75 mile away. Many of the lakes and streams west of Johnson River (30 miles west of Bethel) were frozen, which could account for the concentration of swans at that time. During 165 hours in the field at Johnson River between June 4 and 20, I observed 30 swans (observations on 6 of 17 days), an average of 0.18 per hour. No swans were seen during the plane trip from Bethel to Johnson River and return.

During a 125 mile flight from Bethel to Chevak (just east of Hooper Bay) on June 20, 1946, 2 pairs and 3 single birds were seen. One was sitting on a nest near the shore of a small lake, while its mate was feeding along the shore.

On June 21, 1946 I flew from Chevak to Mountain Village, a distance of 85 miles, observing the greatest concentration of swans—8 single individuals and 8 couples—, totaling 24, and probably representing 8 to 16 pairs. As a rule they were feeding on small lakes. Two were sitting on nests, 1 of which was on an island about 9 feet long near the shore. It was well lined with down, and when we flew over, the adult slid off into the water. We passed over her so swiftly, though, that she returned immediately to the plainly discernible eggs. The other swan had built her own island in the marshy lake border. It was a large mass of vegetation several feet across and also contained eggs. The incubating swan slid off the eggs as we came into sight but returned immediately after we had passed. Her mate was feeding only about 300 feet away. At the second nest the swan's mate was not observed. We did not observe any swans on this trip after crossing the Yukon.

On June 22, we flew from Mountain Village to Marshall, a distance of 60 miles, observing only 1 swan, and that on the south side of the Yukon. From Marshall to Bethel, another 57 miles, an area with a few scattered stunted spruces, but still tundra in nature, we observed 3 groups of 2 swans.—LAWRENCE H. WALKINSHAW, 1703 Central Tower, Battle Creek, Michigan.

TWO BIRDS NEW FOR THE RIO GRANDE VALLEY

On May 13, 1939, a storm of great violence struck Green Island in Laguna Madre, Texas. The following morning a great concentration of passerine birds covered the island. Among the multitudes of warblers, orioles, flycatchers, and other land birds was a small flock of male Bobolinks (*Dolichonyx oryzivorus*). The local authorities stated that to their knowledge this was the first record of the Bobolink for the county, and probably for the entire Rio Grande valley.

On May 6, 1948, while driving from Port Isabel to San Benito we came upon an adult Sooty Tern (*Sterna fuscata*) resting on the road. This individual could not have been in good physical condition for I barely missed catching it in my hands. Aided by a strong wind, the bird just managed to rise and sailed off with an unsteady flight over extensive chaparral

country, and from all appearances settled far out in that area. I have been unable to find another record of the occurrence of the Sooty Tern in the Rio Grande valley.—ALLAN D. CRUICKSHANK, Rye, New York.

SUMMER TANAGER IN MICHIGAN

On November 6, 1948, George M. Sutton and I collected a Summer Tanager (*Piranga r. rubra*) about a mile south of Pinckney, Livingston County, Michigan.

The specimen, an immature female, weighed 28.2 gms. The wing measured 91.5 mm, the tail, 69. The ovary was small and the skull was incompletely ossified. The stomach was full of fruit remains (grape?), with traces of insects. The specimen, number 116078, is now in the Museum of Zoology, University of Michigan.

This bird is the first record of the Summer Tanager for Michigan. However, its occurrence in Michigan is scarcely as remarkable as the date of its occurrence. Even the Scarlet Tanager (*Piranga olivacea*) leaves Michigan long before November, usually by the middle or end of September, although Magee banded a female and noted a male nearby at Sault Ste. Marie on October 21, 1923 (Magee, 1926, *Wilson Bull.* **38** (3): 163). In central Ohio, *Piranga rubra* breeds north to Licking County; in eastern Ohio it ranges farther north; in western Ohio, it breeds only to the general region of Dayton (Hicks, 1935, *Ohio State Univ. Studies* **40** (5): 175).

Although it may be useless to speculate on the reason for the bird's visit, it seems worthwhile to record the fact that the weather during the early part of the month was stormy, and on November 5 and 6 a rather strong south wind prevailed.—HARRISON B. TORDOFF, Museum of Zoology, Ann Arbor, Michigan.

TEXAS HABITAT OF BOTTERI'S SPARROW AND GULF COAST RECORDS OF WINTERING SPARROWS

It is perhaps worth recording that the habitat of Botteri's Sparrow (*Aimophila botterii*) in the Brownsville, Texas, area has changed materially since the publication of Harper's article on that species (1930, Auk, 47, 177–185.). Harper gives a careful description of the terrain between Brownsville and Port Isabel on the coast. Overgrazing, which he specifies as not existing in the area at the time of his visit, is now all too apparent. Once the citrus groves and the richer tableland growth ends and the salt prairie to the east begins, there is no vegetation but a stubbly grass with patches, along the road, of cedars, agarita and mesquite. The typical salt grass association, which appears to be the strict habitat preference of this species and which is well illustrated in his photographs, now occurs only on the very borders of the sea itself or the neighboring lagoons, both near Port Isabel and farther south at Boca Chica. It was here only that I found Cassin's Sparrow (*Aimophila cassinii*) singing from March 11, 1946 on, and later on March 22 farther north above Corpus Christi at Rockport in similar environment. From the above evidence it seems that the summer range of Botteri's Sparrow has been seriously reduced in the Brownsville area of Texas.

The following species were collected and positively identified during this period:

Savannah Sparrow (*Passerculus sandwichensis oblitus*), a common wintering species along the sea edge from Rockport to Boca Chica, taken between March 4 and March 23.

Nevada Savannah Sparrow (*Passerculus sandwichensis nevadensis*), found at Port Isabel in tufts of grass along the beach, March 11.

Western Grasshopper Sparrow (*Ammodramus savannarum perpallidus*), taken at Brownsville and at Austwell, Mar. 3–11. The upper mandible seems to become darker with the approach of the nesting season, starting with the ridge of the culmen and working downwards on each side.

Cassin's Sparrow (*Aimophila cassinii*), was in breeding condition and also in very worn

plumage, from March 11 on. Two specimens show pronounced head moult. Their faint distinctive song carries for well over a hundred yards. A spelling made in the field was: "Tse, Tse, Tseee (prolonged), (interval), uh-tsee, uh-tsee."

Black-throated Sparrow (*Amphispiza bilineata bilineata*), was singing and in breeding condition at Port Isabel as early as March 11.—S. DILLON RIPLEY, Peabody Museum of Natural History, Yale University, New Haven, Conn.

CLOSE PROXIMITY OF TWO NESTS OF AMERICAN BITTERNS

On May 12, 1948, in a marshy pasture 1.5 miles east of Warren, Macomb County, Michigan, I flushed an American Bittern (*Botaurus lentiginosus*) from a nest containing 5 eggs. An examination of the area nearby revealed another Bittern nest 58 feet away which also contained 5 eggs. Both nests were matted platforms of marsh grass built up to a height of about 8 inches above the water, which was ankle deep in the surrounding area. The locality where these nests were found is not a typical marsh habitat but rather a wet meadow with scattered clumps of cat-tails. Bent (1926. *U. S. Nat. Mus. Bull.* **135:** 75) found 5 nests of this species in Saskatchewan in an area 0.25 mile square, but does not indicate the distance between them.—DOUGLAS S. MIDDLETON, 7443 Buhr Avenue, Detroit 12, Michigan.

TWO OBSERVATIONS OF WING-FLASHING BY MOCKINGBIRDS

Twice during the summer of 1947, in Jefferson County, Nebraska, I watched the wing-flashing of Mockingbirds (*Mimus polyglottos*). On July 1, a Mockingbird on the top of a schoolhouse was making 4-foot vertical flights. As the bird paused on the roof between flights it frequently raised and extended the wings in the manner illustrated by Sutton (1946 *Wils. Bull.* **58:** 206–209) and Allen (1947 *Wils. Bull.* **59:** 69–128) This observation is contrary to Sutton's conclusion that wing-flashing is done only when the bird is on the ground. Fear, suspicion, illumination of dark areas, or procurement of food do not appear to have been factors in this instance.

In Perkins County on August 7 a Mockingbird was apparently picking up insects in a fallowed wheat field. This bird flashed the wings outward in a horizontal position, not upward as described by Sutton and Allen. The wings when extended appeared to form an angle of 180 degrees. After appearing to catch and eat several insects, the bird flew to the shoulder of a gravel road, alighting in sparse weedy cover where there were 3 other birds which apparently made up a brood. They seemed to search for food for themselves, and at least 2 birds accompanied their movements with wing-flashes, which amounted to the partial opening of the wings horizontally. Wing-flashing and "begging" calls were noticeable when the adult bird appeared on the ground nearby. Twice the adult alighted near the young birds and flashed its wings as though to attract their attention. Then it moved over to a bird and fed it. Once the adult, after a series of quick dashes and wing-flashes caught what appeared to be a grasshopper.

The adult may have instinctively flashed the wings while searching for food, as Sutton suggests. Since the movements after food were made in an easterly direction, perhaps the wings did serve to take advantage of the early morning light in illuminating crevices in the rather level terrain, as Allen suggests. Wing-flashes on the part of adult and young birds as they approached each other appeared to be signals, although perhaps unintentional and unnecessary.—JOHN H. WAMPOLE, Grant, Nebraska.

CATBIRD ATTACKS SNAKE

On July 3, 1948 about 2 P.M., at Kelly Bridge, 3 miles south of the village of Slippery Rock, Butler County, Pennsylvania, in company with the late Mr. Edmund W. Arthur, and

Mr. John M. McCormick, I encountered a pair of Catbirds (*Dumetella carolinensis*) scolding furiously. We found they were attacking a snake which was about 2 feet above the ground in a crotch of a large apple tree. The snake was about 2 feet long and had its head drawn back in position to strike. An adult Catbird had advanced to within a foot of the snake, apparently trying to catch it by its thin tail.

When we came close the bird backed off a few feet and the snake resumed its climbing of the tree, going straight up the vertical side of the trunk. As soon as the snake got above our heads, the bird closed in again. At a small branch, the snake resumed its defensive position, but the bird retreated only a matter of inches. When once more the snake started to climb, the bird darted in, and, on the wing, grasped the tip of the tail, yanking the snake loose from the bark so that it fell 10 feet to the ground. There we captured it, and tentatively identified it as an immature black racer (*Coluber constrictor*); the snake escaped before we got home, so identification is not positive. The alternative is an immature pilot black snake (*Elaphe obsoleta*). At no time did it actually strike at us or at the birds.

The Catbirds had young, out of the nest, but we could see none in this particular tree. We found one fledgling about 20 yards away. Apparently the bird knew exactly how to handle the snake, and did the job like an expert, in the twinkling of an eye.—F. W. Preston, Box 149, Butler, Pennsylvania.

NORTHERN SHRIKE AT PLAY

Suspended from the top of a 60-foot radio antenna pole near the government school in Mountain Village, Alaska, was a 12-foot length of light rope, having on the end a large knot of frayed rope. On August 25, 1946, this rope was whipping about in a wind of 31 mph. For several minutes a Northern Shrike (*Lanius excubitor*) played an aerial game; the bird would fly down, seize the knot, and then struggle to maintain equilibrium. Apparently he did not try to fly off with his "prey", but only to hold on and remain upright without bumping against the pole. My wife had witnessed a similar performance the previous day. The knot later came off, but I was tempted to tie on another "lure" to see if the bird would play the game for a movie camera.—Henry C. Kyllingstad, Fort Yates, North Dakota.

CONSERVATION

Members of The Wilson Ornithological Club, in touch with its Conservation Committee only through these pages, might easily wonder what kind of work we can do for conservation. The committee, on the other hand, is anxious to be more than a nominal group; which means that we must work closely with our fellow members. Our first concern is the manner in which the club can serve best the cause of conservation; how can we, a widely-scattered ornithological group, fit in with the national picture. The answer, we feel, is to be found in Section 2, Article 1 of our Constitution which states: "The object of The Wilson Ornithological Club shall be to advance the science of ornithology, particularly field ornithology as related to the birds of North America, . . ." Our main job, then, is to conduct original research in ornithology. This is fundamental to bird conservation, hence our position in this field is clear-cut and long established.

Today, conservation is big business. It spends many millions of dollars each year. It sends 1500 delegates to its annual convention. It publishes reports by the ton. Yet with all its money, with all its manpower, the great conservation program in this land of ours promotes but a meagre schedule of fundamental wildlife research. Gustav Swanson most recently pointed this out in his summary of the last North American Wildlife Conference. Anybody who cares to thumb through the transactions, journals and reports produced by our conservation program will note for himself the shortage of original research. Since this is a natural characteristic of the rapid development of the program, we are underlining rather than criticizing this point. It is simply a fact we must face. Administrators, politicians, and taxpayers who put up the money want to see things done right now: tomorrow, next month, or by year's end at the latest. Since research usually labors 2 to 5 years before producing tangible results, it is little wonder that it is not popular with budget committees at this stage of the game.

We must not fret then for want of a job; our obligations to the conservation field stare us in the face. Our main concern is the manner in which we can fit more closely with the national conservation program, and to this end we might organize our thoughts as follows:

1: More work with the larger species. This classification no doubt is awkward, yet stated simply, those birds which are game or predators or which conflict with our civilization are mainly the larger ones. These are the birds which need conservation most, and which have been studied least. The smaller kinds, particularly the passerines, may be studied close to home over long periods with small budgets, hence the greater attention they have received. Yet we must advance to our larger species the same kind of fundamental research which Mrs. Nice applied to the Song Sparrow. It particularly behooves those of our members who are professionally engaged in some phase of the conservation program to help direct research of this kind, and to plant the seed of an idea where a project can grow and thrive.

2: Broadened associations. In the rapid development of professional conservation biology during the last 15 years, the *game manager* or the *wildlife technician* has built up a science of his own which sometimes breaks too far away from the fundamentals of biology upon which it was founded. It has come to the point where the ornithologist and the technician often are worlds apart, having different associates, following different literature, going to different meetings, seldom associating with each other in common understanding. The ornithologist often considers the technician too "practical" in his interests, while one often hears the professional biologists referring aloofly to what they like to call the "*dickey-birders*". Both groups and the birds as well are the losers in this misunderstanding, and we must by all means bring them closer together. That means, of course, aiming first at closer associations within our own club, for our membership includes both groups. We must remember that the pro-

fessional biologist is constantly under pressure to produce practical results; otherwise his funds may be cut short. And the professional must realize that in the meticulous studies which have been made of the Song Sparrow or of the Snow Bunting, there are clues that surely will lead him to a far better understanding of the larger species that concern him.

Moreover, we should extend ourselves to the point of following the work of European biologists more closely. Our general disinterest in overseas biology is appalling, despite the fact that not a few foreign workers such as Lebret, Siivonen, and Tinbergen publish in our own tongue. In waterfowl biology, for instance, there is so very much we could learn about our own problems if we would only give attention to some of the foreign work that has been done with these birds.

3: Cooperation. As a relatively small group, our work is greatly strengthened when we join forces with our associates in other parts of the country. Along this line, Richard H. Pough, Curator of Conservation at The American Museum of Natural History, has drawn up a plan whereby the Conservation Committees of The Wilson Ornithological Club, The American Ornithologists' Union, and the Cooper Ornithological Club will work closely together as a cooperative group. The development of special study projects to be carried out on a long-term basis will be encouraged under this new plan. There will be more about this in the next issue of the Bulletin, but we give notice here that the first of these study projects has been set up in our club under the direction of Walter E. Scott. This will investigate the Old-squaw mortality in the Great Lakes fishing industry. Members living in the Great Lakes region who would like to cooperate on this important project should get in touch with Walter Scott.

There are, thus, 3 specific activities in which members may advance the cause of conservation.

ALBERT HOCHBAUM, *Chairman*

LIFE MEMBER

Dr. A. W. Schorger, a member of the Wilson Ornithological Club since 1927, is president of the Burgess Cellulose Company. He has received degrees from Wooster College, Ohio State University, and the University of Wisconsin. He is a past-president of the Wisconsin Academy of Sciences, Arts, and Letters. Field work has taken him in this country from coast to coast, and to Mexico, England, and Morocco. While most of his published papers are on the present distribution and early history of the birds and mammals of Wisconsin, he has been especially interested in collecting material for a monograph on the passenger pigeon.

LITERATURE

Comments on Recent Literature

Clutch Size in Birds. Great differences exist among the families of birds in the number of eggs laid per clutch. Since the populations of most species remain more or less constant, it is usually assumed that such variations in clutch size represent adjustments to different mortality rates. Yet it is difficult to understand how mortality factors affecting the whole life span of a bird can influence the number of eggs laid. In a recent important series of papers by David Lack on clutch size in birds and litter size in mammals, he points out that natural selection will favor those individuals producing the greatest number of offspring, regardless of potential dangers involved in overpopulation.

Natural selection, operating in the direct manner just suggested, presumably explains the egg laying feats of a codfish or a queen termite. Here physiological capacity (including seasonal cycles of the ovary) sets the only limit upon the number of eggs laid. The same may be true of most reptiles, but among birds it seems to hold only for the Megapodiidae and possibly for some parasitic species—in other words, for birds that do not incubate their eggs or care for their young.

Incubation imposes great restrictions upon clutch size. Sandpipers, for example, lay 4 large eggs; apparently this is the maximum number that can be covered by the parent. In some of the larger gulls a clutch of 3 is very constant and may also be as many as the bird can successfully incubate. These gulls have 3 distinct brood patches, 1 for each egg, suggesting that this clutch size is of long standing. Further evidence of this is the fact that sandpipers and gulls are "determinate" layers (Davis, 1942); if eggs are destroyed or removed during the laying period the birds will not lay additional ones in an "attempt" to complete the clutch as so many birds do.

Although clutch size in gulls, sandpipers, and probably a few other groups is apparently determined by the number of eggs the parent is capable of incubating, Lack believes this to be exceptional. Most species can incubate more eggs than they normally lay. Even the partridge, *Perdix perdix*, which lays as many as 15 eggs, can incubate 20 or more without decrease in hatchability (Lack, 1947). Lack believes that in such species—and this is his most important conclusion—clutch size is equivalent to the maximum number of young that can be reared by a given species at a particular season and locality.

In support of this plausible hypothesis Lack has assembled a certain amount of direct evidence. In the Starling, *Sturnus vulgaris*, banding records show that birds laying clutches of above average size actually leave fewer descendants than do those laying average clutches. Though some of the former group succeed in fledging unusually large broods, the young apparently leave the

nest in a weakened or retarded condition, since their mortality during the first few months thereafter is greater than among birds from broods of normal size (Lack, 1948b). In the Alpine Swift, *Apus melba*, analysis of banding records also suggests that normal clutch size represents the maximum number of young that can be reared (Lack and Arn, 1947). This paper has been criticized at some length by Bender (1948), who emphasizes some of the difficulties involved in such studies, and suggests a number of additional factors which may influence clutch size.

Lack has assembled circumstantial evidence in favor of his hypothesis that is impressive because of its very quantity. Latitudinal increases in clutch size he attributes to the longer days of the northern summer, permitting birds to care for larger broods. In the night feeding goatsuckers this trend is absent. Differences in the number of eggs in first and second broods also seem to agree well with seasonal variations in the quantity of food available. The larger broods usual in cavity nesting birds he considers a result of lessened predation. This permits, without excessive mortality, a longer nestling period than is possible in many species that build open, exposed nests.

If natural selection produces a normal clutch size corresponding to the maximum number of young a pair of birds of a particular species can rear, rapid increases in population might be expected. Such increases are potentially possible but as the numbers of a species mount, its mortality factors operate more stringently and eventually equal the rate of reproduction (Nicholson, 1933). Predation, to mention one population control, increases greatly, as Errington has shown, when a species becomes so numerous as to overcrowd is normal habitats. In the Gray Heron, *Ardea cinerea*, a severe winter sometimes decimates the British population. Recovery is then very rapid, but as competition for food or other essentials becomes sharper, the population again becomes stabilized (Lack, 1946). Clutch size usually remains the same throughout such fluctuations, though in a few raptores it responds to variations in food supply.

This review barely suggests the great amount of data on clutch size and related subjects that Lack has assembled and tabulated. His analysis leads to important conclusions but at the same time reveals the need for much additional investigation. Many of the problems remaining unanswered can be studied to advantage by anyone able to spend some time in the field during the nesting season.

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DEAN AMADON

BOOK REVIEWS

Birds of Cincinnati and Southwestern Ohio. By EMERSON KEMSIES. Ohio Audubon Society, Cincinnati, Ohio, 1948: 8¼ x 11 in., mimeographed, pp. ii + 60.

The region covered by this bulletin includes Hamilton, Clermont, and Butler counties in Ohio. Within the area are Ohio River bottomlands and upland pastures. The author properly calls attention to an interesting local transition between northern and southern birds. Data are given on 292 species and races, most of them represented by specimens, but a few of questionable status. There are brief notes on the ecology of some species.

The American Woodcock is interestingly considered "a regular and frequent summer resident throughout the area". Red-shouldered Hawks are listed as "fairly common summer residents", while Red-tailed Hawks are not recorded as breeding, and are "seen much less frequently than the following species" (i.e., Red-shouldered Hawk). In the nearby Appalachian region, with which this reviewer is much more familiar, the Red-tailed Hawk is generally a breeding species of the broad river valleys, while the Red-shouldered Hawk is much more common in the mountains.

Accidental confusion between the ranges of the Trumpeter Swan and the Whooping Crane seems apparent. On page 15 the Whooping Crane is described as ". . .now almost extinct except for a few pairs in Yellowstone and British Columbia. . .".

Bird students in the Cincinnati region will find Mr. Kemsies' bulletin a very useful publication. Other observers in the Ohio Valley will be interested in comparing local conditions in southwestern Ohio with those prevailing in their own regions.

MAURICE BROOKS

How to Know the Birds: A Simple Aid to Bird Recognition. By ROGER TORY PETERSON. A Mentor Book, Published by the New American Library of World Literature, Inc., New York, N. Y. Pp. 144, profuse illus. in black and white. Paper covers. Index. 1949. Price 35¢. Also published by Houghton Miflin Co., Boston with cloth covers and 5 colored plates. Price $2.00.

The ornithologist has had access to expensive reference books that told him the lengths of bills, tarsi, and folded wings in millimeters, numbers of eggs per clutch, egg measurements, etc. But this inexpensive book tells how to identify birds through perception of their silhouettes, markings, actions, or habitats.

The Peterson Field Guides, superseding all former such publications in their design, may still exclude a number of impecunious bird lovers from owning them, but there is now no excuse for the veriest beggar not to argue with his companion in poverty as to whether that lately-seen bird was a Chipping or a Field Sparrow.

Cheap literature, in the reviewer's opinion, is a blight on the reading public, but in this instance all he can find breath to say is, "Bravo!" We would have a better land and culture

if more of our experts would take time to bring their experience within the compass of casual readers.

So much having been read in general praise of the booklet, the reader might want a few concrete facts. The bird examples are said to be restricted to a small number of types, but actually a wealth of species is included, and only the more-than-average amateur will find lacunae in the coverage. The black-and-white illustrations sustain Mr. Peterson's reputation as a delineator of birds in conventional, functional states. The text sounds no note of condescension, although it is masterfully levelled a pitch or two lower than the language in his Field Guides. There are no technical names. A notable aspect of the book is the series of brief characterizations of each family of birds and further the excellent short sketches of the habitats of birds.

C. BROOKE WORTH

The Parasitic Cuckoos of Africa. By HERBERT FRIEDMANN. Washington Academy of Sciences Monograph number one. xii + 204 pages. 20 figs. 1 map, $4.50.

The present information concerning the habits of the parasitic cuckoos is merged in this book with original observations made by the author in 1924–25. Five genera (15 species) are discussed to the extent that the meager data permits. The distribution, courtship behavior, egg, young, and foster species are mentioned, when known, for each species. The introduction to each genus indicates its place in the evolution of social parasitism.

The 3 species of the genus Clamator are interesting because they show a courtship-feeding pattern and display no instinct to evict the young of the host. Information about the genus Cuculus (4 species) shows that at least some members are less perfectly parasitic than the European Cuckoo. There are traces of courtship feeding and a lack of the evicting behavior in *C. solitarius*. The monotypic genus Pachycoccyx is poorly known as are the 3 species of the purely African genus Cercococcyx. Some of the 4 species of the genus Chrysococcyx, unique among parasitic birds, feed their fledglings after these young birds have left the nest of their foster parents. There is courtship-feeding behavior.

The last 2 pages of the book, titled "A few concluding remarks", comment on some aspects of parasitism all too briefly but then, the data are not available and more extensive comments would be largely speculation. It is hoped that this summary of present knowledge will stimulate additional research.

DAVID E. DAVIS

Tropical Birds (from plates by John Gould). By SACHEVERALL SITWELL. B. T. Batsford Ltd., New York. 12 pp., 16 colored and 2 uncolored plates, $2.00.

Ornithologists interested in good reproductions of John Gould's famous pictures will enjoy this little book. The plates (7 by 5 inches) compare favorably with the original large pictures done nearly 100 years ago. They show 4 birds of paradise, 7 parrots, 2 kingfishers and a toucan, a finch and a fruit pigeon. The notes on the pictures however, are an amazing jumble of miscellany. Some are apparently original observations and are ornithologically worthless, while the style of writing consists of long, involved sentences guaranteed to confuse the reader.

DAVID E. DAVIS

The Flight of Birds Analyzed through Slow-motion Photography. By JOHN H. STORER. Cranbrook Inst. Sci. Bull. 28, 94 pp. Illus., 1948. $2.50.

Ever since man can remember, he has envied birds their ability to fly. Attempts have been made to imitate the birds, but from the earliest recorded case of Daedalus and Icarus, the efforts have been unsuccessful until recently. Modern science and modern machines

have finally overcome man's handicap and lifted him from the ground in a manner that he did not learn directly from the birds.

Part of the reason why it took man so long to learn how to fly was that he had great difficulties in studying and analyzing the flight of birds, because the motions are so fast that usually the eye cannot follow them. It would be interesting to speculate on what the history of human flying would have been if it had been possible to make an exhaustive study of the flight of birds beforehand.

John H. Storer gives in the present volume the results of careful studies on the flight of birds carried out over many years. By making photographs with a high speed motion picture camera and then slowing down the films, many features in the flight of birds become apparent which otherwise are hidden. Thus it becomes possible to find out just how birds are able to propel themselves through the air.

Mr. Storer applies the well established principles of aerodynamics to the flight of birds. He shows that birds and aeroplanes work largely on the same principles. The wing acts as an airfoil; by changing the angle of attack (tilt) of the wing the bird can control the lift. It appears that the birds could not have had a better wing design if they had first taken elaborate courses in aerodynamics.

Different birds have their wing structure specialized for different purposes. Thus, the albatross has a long and narrow wing, giving it a large "aspect ratio" as it would be expressed in aeronautical terminology. This equips it admirably for gliding and soaring. Birds needing great maneuverability have short stubby wings like a fighter plane, enabling them to make quick turns. A hummingbird that can hover almost motionless over a flower uses its wings more like the horizontal propeller of an autogiro. Mr. Storer finds that the flaps of an aeroplane wing, the slots, and other features have their analogs in special feathers which serve the same purposes as their counterparts on aeroplanes. The outer part of the wing constitutes the propeller. It can change its pitch readily, which is even more important than for an aeroplane propeller as it can only make a semicircular motion and then return to its initial position. When the bird soars, the propeller changes its function and merely becomes a part of the lifting wing.

These analogs are explained in simple, non-technical language and illustrated by many photographs and diagrams so that it is easy for the average bird lover to follow. The book is intended for the nature lover, the biologist and the aviator. In the words of the author: "The biologist will see the reason for the structure of bone and feather as each part of the wing takes, for a split second, some unexpected shape and position. The aviator will find interest in the similarities of design and function in bird and plane. The nature lover will discover new beauty and logic in his favorite subject."

G. H. Dieke

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See also *Food and Feeding Habits:* Ramsay and Cushing.

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See also *Life History and Behavior:* Fitter.

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OBITUARY

Dr. Thomas Calderwood Stephens died at Sioux City, Iowa, on November 24, 1948, aged 72 years. A half of his span of life was spent in distinguished service to ornithology. Though taking a degree in medicine, he could not resign himself to reducing this training to practice. A fondness for the biological sciences and an inherited bias for teaching led him to accept the chair of biology at Morningside College. He resigned from the professorship in 1946 after 40 years of continuous duty. He taught also for 16 summers at the Iowa Lakeside Laboratory where classroom instruction was supplemented by field trips to permit his students to learn the habits of birds in their natural surroundings.

The editing of a scientific journal requires not only a broad knowledge of the particular science but unlimited time and patience. In 1925 Dr. Stephens succeeded Prof. Lynds Jones as editor of the Wilson Bulletin and served in this capacity until 1938, a period of 14 years. Dr. R. M. Strong paid a well deserved tribute to these men when he wrote: "Finally, some consideration should be given to the devoted and effective work of the editors of the publications of the Club and especially to Professors Jones and Stephens. . . . Dr. Stephens, taking on the duties of editor, . . .has been conscientous and highly successful." Prior to assuming the editorship he served as President of the Wilson Ornithological Club from 1914 to 1916.

The broad range of his interest in birds is shown by his membership in other societies such as the American Ornithologists' Union, Cooper Ornithological Club, Iowa Ornithologists' Union, Nebraska Ornithologists' Union, Sioux City Bird Club, Iowa Academy of Science, and the Sioux City Academy of Science.

The number of his publications on birds is approximately 75. Living in extreme western Iowa, contiguous to Nebraska and South Dakota, his ornithological activities knew no boundaries. In 1945 he published privately, "An Annotated Bibliography of South Dakota Ornithology." He was engaged at the time of his death on manuscripts covering the ornithological bibliographies of Iowa and North Dakota, the birds of Woodbury County, Iowa, and those of Union County, South Dakota.—A. W. Schorger.

Benjamin Franklin Bolt, as associate member of the Wilson Ornithological Club for 35 years, died in Kansas City, Missouri on January 1, 1949 at the age of 78. He was born on March 26, 1870 in Elmwood, Illinois where at the age of 12, he became interested in ornithology. In the Kansas City region he accumulated a representative collection of birds' eggs and an extensive library on the subject of birds, and was considered the best read man in this section of the country in the literature on ornithology. Mr. Bolt was a quiet, mild-mannered gentleman and a fine companion in the field.—Dix Teachenor.

THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received. From:

R. M. Anderson—1 book
A. J. Berger—1 reprint
L. V. Compton—14 books, 60 periodicals, 638 reprints
David E. Davis—1 book
Adrian C. Fox—1 book
Leon Kelso—1 pamphlet
Emerson Kemsies—1 book
Henry C. Kyllingstad—1 reprint
Robert M. Mengel—1 reprint
Allan R. Phillips—8 reprints
Frank A. Pitelka—1 book, 1 collection of pictures
Katie M. Roads—1 book, 10 reprints
Haven H. Spencer—1 book
Milton B. Trautman—8 reprints
J. Van Tyne—5 reprints
Lawrence H. Walkinshaw—11 reprints

REPORT OF THE TREASURER FOR 1948

Balance as shown by last report, dated Dec. 31, 1947	$180.21	
Receipts, Jan. 1 to Dec. 31, 1948		
Dues:		
Associate	1,562.65	
Active	1,872.90	
Sustaining	695.00	
Subscriptions to *The Wilson Bulletin*	158.75	
Sale of back issues of *The Wilson Bulletin* and of reprints	259.67	
Interest from Endowment Fund	150.97	
Contributions for printing colored plates	50.00	
Contributions to Library Book Fund	43.55	
Gifts; miscellaneous receipts	6.58	
Total receipts		$4,980.28
Disbursements		
The Wilson Bulletin: printing, engraving, mailing	$3,442.26	
Purchase of back issues of *The Wilson Bulletin*	176.69	
President's expense: printing, postage	33.05	
Editor's expense: reprints, postage, secretarial aid	462.51	
Secretary's expense: stationery, postage, clerical aid	205.01	
Treasurer's expense: stationery, postage, clerical aid	219.93	
Membership Committee's expense: postage, printing	292.42	
Contribution to European Ornithologists Relief Fund	50.00	
Purchase of books for Library	12.25	
Dues to Ecologists Union	4.00	
Bank charges: taxes and foreign exchange	4.36	
Total disbursements		$4,902.48
Balance on hand in Citizens Fidelity Bank and Trust Co., Louisville, Kentucky	77.80	
Louis Agassiz Fuertes Research Grant Fund (special gift)	400.00	
S. Morris Pell Fund (special gift)	100.00	

ENDOWMENT FUND

Cash balance in savings account, Dec. 31, 1947	$1,231.44	
Received during year:		
Interest on U. S. bonds and on savings account	150.97	
Life Membership payments	500.00	
Gift from Jennie N. Putnam Estate	500.00	
Sale of U. S. Savings Bonds, Series C, dated Aug. 1, 1938	1,075.00	
Total		$3,457.41

Transferred to checking account (interest)	150.97	
Purchase of U. S. Savings Bonds, Series G, dated June 1, 1945	500.00	
Purchase of U. S. Savings Bonds, Series F, dated Apr. 1, 1948	1,480.00	
Purchase of U. S. Savings Bonds, Series F, dated Oct. 1, 1948	1,073.00	
Bank charge (State tax)	.15	
Total	$3,204.12	
Balance		$253.29
Bonds:		
U. S. Postal Savings Coupon Bonds, dated July 1, 1935		780.00
U. S. Savings Bonds, Series G, dated Sept. 1, 1943 (maturity value, $1000.00)		949.00
U. S. Savings Bonds, Series G, dated Dec. 20, 1944 (maturity value, $1500.00)		1,420.00
U. S. Savings Bonds, Series G, dated June 1, 1945 (maturity value, $500.00)		474.00
U. S. Savings Bonds, Series G, dated July 1, 1945 (maturity value, $900.00)		855.90
U. S. Savings Bonds, Series G, dated Oct. 1, 1945 (maturity value, $1400.00)		1,331.40
U. S. Savings Bonds, Series F, dated Feb. 1, 1947 (maturity value, $2000.00)		1,490.00
U. S. Savings Bonds, Series F, dated Apr. 1, 1948 (maturity value, $2000.00)		1,480.00
U. S. Savings Bonds, Series F, dated Oct. 1, 1948 (maturity value, $1450.00)		1,073.00
Total Endowment Fund		$10,106.59

Note: Bonds are listed at their present redeemable value.

Respectfully submitted,
BURT L. MONROE, *Treasurer*

December 31, 1948
Approved by Auditing Committee
R. ALLYN MOSER
MILTON B. TRAUTMAN

Editorial Committee

1949	1949–50
Dean Amadon	Hustace H. Poor
Lincoln V. Domm	George Miksch Sutton
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Editor of the Wilson Bulletin

DAVID E. DAVIS

Assistant Editor

C. HAVEN KOLB, JR.

Recommendations for Preparation of Manuscripts

Manuscripts should be typed on one side of white paper of good quality with title and author's name written on a separate sheet. Everything should be double-spaced and each table should be typed on a separate sheet. Figures, not words, should be used for all numbers (except at the beginning of a sentence). Sex ratios should be calculated as % males. Express data in quantitative and tabular form, wherever possible, and when giving averages, also give the standard deviation. The technical names of the A.O.U. Check List (4th edition), as corrected in the supplements, should be used. Unless specimens have actually been identified to subspecies, only the specific name should be used. Whenever possible a reference for technical names of plants should be listed. Literature should be listed at the end of the article in accordance with the style in previous issues. All articles should have a summary. Authors should avoid footnotes and vernacular phrases. Illustrations should have good contrast. Printing on charts and maps must be large enough to permit reduction. Cuts of figures will be destroyed unless author requests their return on the reprint order form.